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ON NATURAL PHOSPHATES.

By J. Lainson Wills, F.C.S.

(*Delivered 12th March, 1892.*)

When your President and Treasurer did me the honour to request me to read a paper on "Phosphates" before the Ottawa Field-Naturalists' Club, I hesitated in complying.

"Phosphates" in a general way, as we employ the word in this locality, implies the crystallized Mineral Apatite, so abundant in certain parts of our Laurentian formation. The good work done by the Geological Survey, has from time to time, through its officers, kept us well informed of the localities and peculiarities of the occurence of the Canadian Apatite, by valuable contributions form the pens of Sir Wm. Logan, Sterry Hunt, Vennor, Dr. Geo. Dawson, Torrance, Dr. Robert Bell and others. At the present time, I understand that Mr. Ingall also, who has been in charge of a special study of our Canadian Apatite fields, is about to terminate and publish his preliminary report, so with deference to his opportunities and approaching publication, I could not presume to undertake a paper purely on Canadian Phosphates or Apatites as was proposed, but thought it might be acceptable to our members here, to give their attention to a more extended and general consideration of natural mineral Phosphates, and hence the title of my paper this evening, instead of being "Canadian Apatite" is "Natural Phosphates" in a general way. My present occupation prevents me from giving much time and study to the preparation of this work, but if by some generalization of facts, we can awaken a healthy discussion and exchange of ideas, my humble attempt will not have been useless.

Natural phosphates owe their commercial value to the proportion of phosphoric element contained in them, and are employed as raw material for the manufacture of phosphatic fertilizers, being also sometimes applied in the natural and raw state direct to the soil by the farmer. They are also in demand for the manufacture of phosphorus, baking powders and some other chemical products. By far the greatest demand for them, however, is made by the manure manufacturers for

agricultural requirements, and this demand is yearly increasing at a very rapid rate. The occurence of natural phosphates presents the most varied and interesting modes of formation, as may be surmised by finding their deposits, not only in nearly every geological system, but in many different series of the same system.

Now in beds which may be, have a fresh water or marine origin, now appearing as hardened conglomerate or rocks, and sometimes as sand and loose gravel: then again in vein formation or pockets, sometimes amorphous, at other time crystallized.

In the matter of texture, colour and other physical characters, we find the same endless variation.

The origin of the demand for these phoshatized products is comparatively of recent date. It was only in the commencement of the present century that crushed bones were employed as a fertilizer in agriculture, and strange to say, only then on occount of the gelatine or organic matter they might contain.

The following curious statement which appeared in a scientific journal in the year 1830, *a propos* of the employment of crushed bones in England, exposed the ignorance on the subject at that day and reads as follows:—"As to earthy matter or phosphate of lime contained in the bones, we may disregard it. It is insoluble and indestructible, and *cannot serve as a manure*, even in damp soil, and in immediate contact with the rootlets of the plant."

The suggestion of Liebig, to treat the bones with sulphuric acid, opened a new era, to the utilisation of phosphatic materials in agriculture and the manufacture of artificial manure was soon established.

The illustrious Elie de Beaumont thus expressed himself with regard to the commencement of the mining of mineral phosphates. *"Colbert has said that France would be lost for want of forests, and everyone perceives that without coal his prediction would soon be accomplished. In his day, one would have failed to comprehend how a great country might disappear."

NATURAL PHOSPHATIC DEPOSITS.

These valuable provisions of nature are the result of various causes and agencies familiar to the geological observer and their contained

*Jean Baptiste Colbert, born 1619, Minister of Finance to Louis XIV.

phosphoric acid is mostly due to animal life; and when we say "due" to animal life we wish to imply that animal life is the assimilating and concentrative medium of pre-existing phosphoric acid: whether as sea and fresh-water shells, as fish and animal bones, as excreta of birds and saurians, etc., animal organisms have been from the beginning of life and still are, the silent but mighty laboratory of nature, never resting to collect and store up the dispersed molecules of phosphoric acid. Among such are the guano beds of recent epochs, coprolite deposits, bone beds, shell beds, etc.

Nature's operations of bringing these materials or their debris together to form whole geological areas are equally varied, but the estuaries and depressions of the sea-bottoms of the different and respective geological periods, are recognized to have been the receptacles or storehouses of these wonderful supplies. A curious disposition to concretionary action, displayed by nuclei of certain organisms to absorb and accumulate phosphatic matter, with which the ancient seas abounded, is more easily seen in its effects than explained.

Such is the origin of many odd species of nodules, some varieties of which exist in immense quantities.

The abrupt or imperceptible, but never ceasing operations of geological rearrangement, follow the afore mentioned accumulations, and we then have new forms of mineralized phosphatic matter, giving rise to conglomerates, breccias, phosphatic limestone, shells and marls, sandy and ablation deposits, etc., and most of the known natural deposits of mineralized phosphate display examples of two or more of these products. For instance, the perplexities experienced just now with some of the exploratory workings of the lately discovered Florida deposits, are chiefly occasioned by the character of these beds containing boulders, and nodules from pea size to masses of several hundred pounds in weight, fish bones, sharks' teeth and fossil bones, in fact *debris* from several geological epochs, each of these materials naturally varying in purity, and therefore also in commercial value, so that the more successful enterprises may be looked for where regular and homogenous deposits occur, or some cheap and efficient mechanical means are applied for the separation of the marketable products from the less valuable or worthless intermixtures.

The classification of natural phosphates of lime is, as remarked by Dr. Penrose in Bulletin No. 46 of the U. S. Geological Survey, "a matter attended with many difficulties, not only on account of the great variety of forms in which phosphate of lime occurs, but also because many varieties blend into one another, thus often rendering it uncertain to which class a special deposit should be referred," and he adopts the following classification, based mainly on the chemical composition of the deposits, and grouped under the headings thus :—

- Mineral Phosphates
  - Apatites
    - Fluor-Apatites
    - Chlor-Apatites
  - Phosphorites
- Rock Phosphates
  - Amorphous nodules
    - Loose nodules.
    - Cemented (conglomerates)
  - Phosphoric limestone beds
  - Guanos
    - Soluble guanos
    - Leached guanos
  - Bone beds.

We shall recognise as we proceed with the study of the various phosphatic deposits, formed during the different geologic periods, that by far the greater part owe their origin to animal or organic remains, and we shall see that as soon as the organic compounds of a guano, for example, are dissipated and resolved into their elements, we may consider that the residual products, to all intents and purposes, revert to the mineral state, in accordance with the familiar expression " earth to earth."

We pass over, for the present, the guano of various localities, which however will be observed to lie mostly within 10 to 20 degrees of the equator.

We should remember, however, that this product has attained its zenith, both as to quality and quantity, and must cede its commercial importance ultimately to the mineral resources of phosphoric acid, which are before us for our more particular consideration.

We shall find the diagram on the wall which shows the approximate geological position or age of the different phosphate deposits, very useful to our present purpose, and we will commence with the more recently formed or mineralized products.

OCCURENCE OF NATURAL PHOSPHATES IN THE GEOLOGICAL EPOCHS.

Post-tertiary or Quarternary System.

True guanos.
Crust or "leached" guanos.
West Indian and Pacific Phosphates.

Tertiary System.

West Indian Rock Phosphates.
Nassau or Lahn nodular concretions.
Suffolk Coprolites in the Red Crag and Coralline Crag. (Reposing on the Lower Eocene)
S. Carolina beds, resting upon Eocene.
Deposition of Florida phosphate debris and organic remains.
N. Carolina overlying Eocene marl.
Fundamental rock of Florida Phosphate deposits.
Clays and *debris* of Bordeaux Phosphates.

Cretaceous System.

Belgian (Liege) Hesbaye nodules.
American Alabama amorphous nodules.
New Jersey marls.
Belgian (Mons) Ciply nodules (Maestricht beds).
Somme deposits, arenaceous and nodules.
Russian "Samorod" nodules Desna-Don.
Cambridgeshire and Bedfordshire Coprolites.
French nodules of Ardennes, Meuse.
" " Montpellier and Bellegrade.

Oolitic or Jurassic System.

Bordeaux Phosphorites and nodules overlain by Tertiary (Eocene) clays and *debris*.
Algerian Phosphates.

Triassic System.

Highly phosphatic beds (between Trias and below Lias) containing exuviæ of huge reptiles as well as remains of fish and crustaceans.

Permian System.

(Appearance of reptilia.)

Carboniferous System.

(Appearance of Amphibia.)

Devonian or Old Red Sandstone.

Highly phosphatic beds in conjunction with Lower Carboniferous.
Highly phosphatised beds in Shropshire, containing oldest known remains of vertebrate life associated with crustaceans.

Silurian System.

(Appearance of vertebrata)
Welsh Bala beds. Berwyn Phosphate mine.
Lingula flags (Quebec) 40% tribasic.
Angers slates (France).
Phosphate limestone of Kentucky.
Logrosan (Spain) Phosphorities (Apatites?)
Caceres (Spain) "
Portugal "

Cambrian System.

(Appearance of Protozoa, Mollusca, Annuloida, and Crustacea.)

Laurentian System.

Canadian Apatite.
Norwegian Apatite.

Thus at the present time, we have Mineral phosphates of lime in process of formation, and principally known in commerce as "Crust guano".

Looking at the chemical composition of average Bird guano, we find it to be composed of the following constituents:—

Moisture	15.8
Organic matter and Ammoniacal Salts	52.5
Phosphates of lime	19.5
Phosphates of Iron and Alumina	3.1
Alkaline Salts	7.6
Silica and Sand	1.5

This typical analysis is from the average of 15 samples, made by Nesbit on the Chinchas Inland Guano.

An elementary knowledge of chemistry will assist us to perceive what a large proportion of the above constituents will be leached out by water, or dissipated by prolonged exposure to ordinary atmospheric influences, especially when we remember that the organic matter above mentioned comprises uric, oxalic and phosphoric salts of alkalies and ammonia, and even about one third of the phosphates of lime is found to be soluble in water. Given a deposit of guano on a limestone soil or rock, and it is readily perceived that every shower will contribute to the steady but continual process of the transmutation of the carbonate of lime into phosphate of lime, in consequence of the discharge of the weaker carbonic a[illegible] by the stronger phosphoric acid.

The exhausted guano then becomes phosphatic in distinction to being nitrogenous and ammoniacal ("leached"), and the subjacent limestone undergoes a metamorphosis by a double decomposition, into phosphate of lime. If the absorbing limestone is pure, the phosphate of lime formed thereby will be correspondingly pure; and on the other hand, if the calcareous base is intermixed with clay or sand or ferruginous material, the newly formed product will contain alumina, silica, oxide of iron, etc., in like proportions.

Such has been the undoubted origin of the deposits of Aruba Rock phosphate, samples of which are on the table, and which are typical of this kind of metamorphosis and will serve to illustrate many similarly formed deposits, notably those of Curaçao, Sombrera, Navassa and Redondo (in which latter case the subsoil must have been aluminous, since the mineral is a phosphate of alumina).

In some cases the phosphatic principle may have been derived from animal *debris*, such as bones.

The composition of animal bones varies somewhat, according to the animal furnishing them, and even with the particular part of the same animal, but the following analysis, expressed in 100 parts, may be taken as an average :—

	Green Bones.	Bone Ash.
Moisture Organic matter	33. (gelatine)	
Phosphate of lime	56	70-75%
Phosphate of Magnesia	3	
Carbonate of Calcium	3	
Alkaline Salts	4	
Silica		

The bones of birds are even richer in phosphoric acid than those of animals, but bones of amphibia and fish contain less than those of birds and animals.

Amongst other animal organisms rich in phosphoric acid or phosphate of lime may be mentioned certain shell fish, or rather their shell remains, notably the shells of *Lingula* and *Orbicula*, which consist for the greater part of phosphate of lime, and are found in accumulated beds in the Lower Silurian rocks, being thus described by Sir Wm. Logan (Geology of Canada, 1863) :

Those coming from the Chazy formation at Alumette Island, left after calcination 61% of fixed residue, consisting of :

Phosphate of lime	85 7
Carbonate of lime	11 7
Magnesia	2 6
	100 0

and analysis of the original material gave as follows :—

	Alumette.	Hawkesbury.	R. Ouelle.
Phosphate of lime	36.38	44.70	40.34
Carbonate of lime and some fluorine	5.00	6.60	5.14
Carbonate of Magnesia		4.76	9.70
Oxide of Iron and Alumina	7.02	8.60	12.62
Magnesia			
Insoluble	49.90	27.90	25.44
Volatile by heat	1.70	5.00	2.13
	100.00	97.56	95.37

We here observe an average of 40% of phosphate of lime. It would appear that our knowledge of the proportion of phosphatic element in similiar animal remains is very imperfect, so that upon further investigations, we may expect to meet with many other similar accumulated supplies of phosphoric acid.

Some authorities attribute a large portion of the phosphate of lime in the Charleston fields to such molluscs and principally *Lingula pyramidata*, which are found abundantly on the present coast.

CLASSIFICATION OF NATURAL PHOSPHATES.

I prefer for all practical purposes and from rational observation to modify the classification proposed by Dr. Penrose, thus :—

Apatites	Fluor-Apatites. Chlor-Apatites.
Mineral and Rock Phosphates	Phosphorites. Nodules, Coprolites. Concretions. Conglomerates. Phosphatic Limestone. Phosphatic Marls. Crust Guanos.

Guanos	Nitrogenous. Phosphatic, or "leached." Bat Guano.
Animal remains	Bone beds. Shell beds. Animal exuviæ.

We will now proceed to trace in a cursory way the commercially known deposits, commencing with the most recent, and passing stratigraphically in descending order to the more ancient formations.

GUANOS.

Guanos are of two kinds—Nitrogenous or those containing their original manurial qualities, and phosphatic or "leached," the latter being in a more or less mineralized condition by exposure to weathering.

Among the Nitrogenous guanos, we have the Peruvian, Ichaboe, Patagonian and Falkland Islands.

The phosphatic or weathered guanos include those of the Pacific or Polynesian Islands, Sidney, Phœnix, Starbruck, Baker, Howland, Jarvis, Enderbury, Malden, Lacepede and Arbrohlos Islands.

Some of these deposits are more or less exhausted, and new Islands furnishing similar products are from time to time worked.

The West Indian guanos are from Aves, Mona, Tortola.

Other South American are Patos Islands, Megillones, Rata.

From Africa, Saldanta Bay and Kuria Muria Islands.

Bat Guano, the product from the floors of caverns inhabited by bats, have sometimes been sent to market as a rich fertilizer. It is found notably in Cuba (W. I.) and in N. Borneo. It possesses a characteristic dark brown colour and exhibits the undigested parts of beetles wings and insect *debris*.

BONE BEDS.

These are found in nearly all sedimentary strata, from the Devonian up to the present time, but with the appearance of those remarkable reptilia in the Permian age, we find that these kinds of phosphatic provisions of nature took enormous developments, augmenting the resources previously furnished by the amphibia of the Carboniferous epoch.

Bone beds, however, in their original state have furnished little to commercial supplies of phosphatic products, except those found in the Tertiary and Quarternary ages, such as Bordeaux, Carolina, Florida and Sombrero (breccia).

SHELL BEDS.

Since these must have existed from a time well into the Paleozoic periods, or that is to say, from the Cambrian age, we may expect and do find these mollusca remains, through a wide range of systems and strata and up to recent times.

The Silurian Lingula beds are remarkable, and have been already particularized as a probable abundant source of phosphoric acid.

The Welsh Silurian beds, and the French Bellegarde and Ardennes deposits in the lower Green-sand (Cretaceous), exhibit evidence of this origin, while the Tertiary and Quaternary phosphates contain very frequently these marine and fluvatile remains as a contribution to their value in phosphate of lime.

Some very interesting specimens are on the table from the Dutch West Indies, containing from 75 to 80% of tribasic phosphate of lime, and exhibiting in some cases, one mass of shells belonging to recent times.

COPROLITES.

Owe their name to Professor Henslow, and should be applied only to the fossil exuviæ of animals. The appelation has extended itself to many rolled or gravelly products, chiefly found in the Cretaceous formation. In England they have been worked to a large extent in Bedfordshire and Cambridgeshire, where they appear in the (Neocomian) strata, between the chalk and the subjacent Jurassic system, in nodules and pebbles of size from a pea to a hen's egg, and sometimes cemented by ferruginous sand into a hard conglomerate; organic remains are present, and casts and fragments of fossils with abundance of ammonites, vegetable remains and other debris of the Jurassic epoch, (*Iguanodon* and *Megalosaurus*, etc.).

The commercial products contain from 45 to 55% phosphate of lime.

The Coprolites of Suffolk occur in the Tertiary, being in the older Pliocene (the Red Crag and Coralline Crag). They are poorer in phosphate of lime, more ferruginous and harder in texture.

France also possesses some deposits of this character at Bellegarde, near the Swiss frontier, and also at Montpellier and Avignon, yielding 54% tribasic phosphate of lime.

NODULAR, CONCRETIONARY AND ARENACEOUS PHOSPHATES.

These by far the most important of nature's phosphatic reserves, comprising as they do, the South Carolina deposits, the French deposits of the Somme, Ardennes and Meuse, the Belgian fields of Mons and those more lately opened up at Liege (Hesbaye). The so-called "Bordeaux Phosphates," because being formerly shipped from that port, but having their real origin in the region of Quercy, comprising portions of the departments of the Lot, Tarn and Garonne and Aveyron, also furnish a considerable quantity of nodular or phosphatic concretions of kidney shape of great purity (88%), and curious geological interest. These are well represented by specimens on the table, and coming from the crevices in the Oolitic limestones, accompanied by *debris* of Tertiary age (Eocene), the walls of the crevices or fissures being at the same time incrusted with phosphorite of a high degree of purity attaining 80% of tribasic phosphate of lime.

We must not omit here the Florida nodular beds of land and river formation, which are now enjoying such a glorious boom.

As a peculiarity of this Bordeaux phosphorite, we may mention that it contains a very appreciable proportion of iodine.

The Russian deposits, situated between the Rivers Desna and Don, occur in the Cretaceous system, at about the same horizon as the Cambridgeshire coprolites and may be described as nodular.

The Nassau or Lahn concretions in clay are of Tertiary age, and although not exhibiting signs of organic remains are generally believed to be of animal origin, they attain 60 to 75% phosphate of lime, but too ferruginous to be much in request for superphosphate manufacture.

The Belgian (Ciply) deposits, which have furnished over 150,000 tons per annum of a 40 to 50% product, are of a nodular character, although the grains are often so fine as to be considered more correctly arenaceous.

The same may be said of the very remarkable French deposits, discovered near Amiens in 1886, and known as the Somme phosphates.

These are granular or arenaceous, and to this feature as well as to their richness (65-80%) may be attributed the enormous development which they have enjoyed in such a short period, attaining the annual productien of 200,000 tons.

CONGLOMERATES AND BRECCIAS.

Phosphatic beds may also assume these characters, sometimes with the cementing material as the phosphatic element, and at others with the enclosed pebbles or angular fragments as the valuable portion for commercial supplies.

Thus the Cambridgeshire coprolite fields furnish a conglomerate of phosphatic pebbles, cemented by ferruginous sand, while in the Ardennes district (France), is found a peculiar agglomeration of granules of chlorite in a phosphatic cement, the whole yielding 40 to 45% phosphate of lime.

The Belgian (Cipley) deposits yield abundant supplies of a mass of phosphatic nodules, shells casts and fossils, cemented in a calcareous matrix, to utilize which, has puzzled the ingenuity of many an "*exploitant.*"

PHOSPHATIC LIMESTONE AND MARLS.

Are found in most strata from the Silurian epoch down to more recent time.

The metamorphosis or transmutation of earthy carbonates into phosphates, is a very simple and comparatively rapid process, and the evidence of Dr. R. Ledoux in the following description is instructive. He says in a recent article on Phosphates:—"Some clients of mine sent a ship to a coral island in the Southern Pacific to bring away a cargo of bird guano. The birds were still in countless thousands. The captain had been there for a load 20 years before, and since that time no guano had been removed. At his first visit the crew had cleaned off a space and made a house of coral rock, covering it with a sail and had used it for a shelter and storehouse while at work. On leaving, the sail was taken away and the walls and board floor left. On the return, 20 years after, there was an average depth of 20 inches over the floor—an inch a year. The underlying limestone was altered into Phosphate for a depth of several feet, but the conversion of carbonate into phosphate gradually became less perfect as depth from surface was attained."

I have observed the same effect myself taking place in the West Indies, where the surface of the coral rock is speedily converted into phosphate of lime, wherever the seabirds are in the habit of congregating.

Such indeed is the simple origin of some of the most important deposits of phosphate in that portion of the world : i. e., Curacao, Sombrero and Aruba, etc.

The prospecting and first development of the latter named island having fallen to my own care and experience, I am able to produce some interesting specimens here, illustrating very clearly the history of their formation, by examination of their fossil organisms, originally carbonate of lime (coral rock), and now seen to be, by analysis, phosphate of lime of over 80%.

The deposits of Florida and South Carolina would appear to owe much of their phosphatic wealth to *debris* of phosphatized limestones and marls.

One of nature's operations, which is a factor in enriching already-formed phosphate beds, may be here alluded to, namely, the property of spring waters (which often contain considerable proportions of bicarbonates and free carbonic acid) to disolve neutral carbonate of lime, even when presented to them in apparently as the most compact and impervious material. Such has been the origin of the many remarkable caves existing in the limestone rock formations (Cheddar, Derby, Kentucky, etc.)

This property applied to a calcareous phosphated material will, in course of time, ablate, as it were, more carbonate than phosphate, and to this action is attributed the value of many thousand tons of material, in such extensive beds as those of the Somme, Ciply, Liege, and probably of Florida.

While speaking of these beds of the Cretaceous period, I may mention the recent opening up of another similar field in France. I refer to that in the department of the Pas de Calais, which would appear to be of the same nature as that of the Somme.

APATITES.

Although crystallized phosphate of lime is found as a component of rock masses in more recent strata, yet we do not yet know of any

workable deposits of this mineral before passing to the oldest of fossiliferous systems, the Laurentian.

The rocks of this formation are among the most ancient on the North American continent and probably correspond to the oldest gneiss of Scandanavia. The modes of occurence are so varied in the Canadian Apatite field, that the subject would require to be treated by itself in order to do it justice here.

We are all here familiar with how it is found, both in Ontario and Quebec provinces.

Dr. Hunt thus describes in 1884, the main features of its mode of occurence: "The deposits of Apatite are in part bedded or interstratified in the pyroxenic rock of the region, and in part are true veins of posterior origin. The gneissic rock with their interstratified quartoze and pyroxenic layers, and an included band of crystalline limestone, have a general northeast and southwest strike, and are much folded, exhibiting pretty symmetrical anticlinals and synclinals, in which the strata are seen to dip at various angles, sometimes as low as 25 degrees or 30 degrees, but more often approaching the vertical. The bedded deposits of apatite, which are found running and dipping with these, I am disposed to look upon as true beds, deposited at the same time with the enclosing rocks. The veins, on the contrary, cut across all these strata, and in some noticeable instances, include broken angular masses of the enclosing rocks. They are for the most part, nearly at right angles to the strike of the strata, and generally vertical, though to both of these conditions there are exceptions. One vein, which had yielded many hundred tons of apatite, I found to intersect, in a nearly horizontal attitude, vertical strata of gneiss, and in rare cases what appear, from their structure and composition to be veins, are found coinciding in dip and in strike with the enclosing strata."

The apatites of Norway are known since 1854, and occur on the southern coast in similar rocks to our own (Canadian), and many of the associated minerals are similar to those observed in the Laurentian rocks, the vein matter differing chiefly in freedom from carbonate of lime.

Rutile may be mentioned as an exception, which in some mines is so abundant as to form a considerable revenue to a working mine, since

it is worth 1/6d. per lb., say $800 per ton. These are fluor-apatites, although they contain also some chlorine.

Continental geologists (Brogger and Rensch) who have studied these formations, have supposed them to be of eruptive origin, in consequence of the absence of phosphoric acid in the surrounding rocks, but the question seems to be most doubtful, as well here as in the case of the same opinion held on the Canadian Apatite deposits.

THE SITUATION OF CANADIAN PHOSPHATE TRADE.

Although this Canadian industry has not progressed on the same scale as many other phosphate fields, Somme, Cipley, Liege, Carolina and Florida, yet there are some facts offering an explanation for this. The peculiarity of the occurence of the mineral in vein-like formation in hard rock, calls for a scientific and economic system of mining, which has been little applied to the development of our deposits, and the cost of production is thereby more considerable than that attained in other fields of supply.

Certain centres of manure manufacture still require our high testing products to complete their standard types of concentrated supers, and the rapidly increasing demand for fertilizers by all the civilized world, both the new and the old, will tend to maintain a fair value for natural phosphates. We are getting into the era in which steam does not work fast enough, and on every hand we are seeking to accomplish our ends by electricity with lightning speed. Someone has said that the man who could made two blades of grass grow where one grew before, was a benefactor to his race, but the rush and the struggle for existence imposes that every cultivator shall be a benefactor in this regard, and carry on agricultural science at the highest possible tension for his very existence.

With increasing populations, with better means of transport, and lastly but not least, advanced scientific education, fertilizers and all other artificial means of stimulating our exhausted soils will continue to be in increasing demand.

We see no reason therefore to suppose that the mineral-phosphate Industry or phosphate mining has attained its zenith, and so far as we can see at present, the future demands of the world for phosphoric acid are destined to increase with time and agricultural progress.

RÉSUMÉ.

We may shortly generalize the foregoing facts and observations.

Of the sixty four elementary substances at present known to compose the material of our original globe, phosphorus is found to be among the twenty more abundant elements, and is recognized to have been widely disseminated in all the original and ancient rock masses. With the exception of the segregations of crystallized Apatite in the Laurentian rocks, we do not find any marked local accumulation of phosphatic bases in any of the azoic formations, or intrusive rocks.

The existence of the Eozoon Canadense is still debatable, and it is problematical whether the apatite of these older metamorphosed strata is not the mineralized product of organic remains, but passing from the Laurentian epoch to the succeeding and less altered rocks we are immediately in presence of abundant evidence of organized life, and cannot fail to remark how much more frequent are the accumulations of phosphatic beds.

The function of organized life to assimilate and concentrate the disseminated phosphoric element is strikingly apparent. The natural forces which are ever restless and continual in building up the varied geological strata of succeeding epochs (attrition, deposition, cementation, ablation, etc.) may alter and vary the manner of presentation of the phosphatic deposits which we have been considering, but the silently working power of assimilation by the organized cell, would appear to triumph over the mighty disruptive and more violent operations of nature, for the latter forces fail to re-disseminate the work accomplished by the former, but rather complete the task required to secure to man the providential supplies of phosphatic deposits with which we may satisfy our present demands, and therefore these economic supplies are seen to be chiefly in the more recent geological formations.

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ANNUAL REPORT OF THE COUNCIL FOR 1891-1892.

To the Members of the Ottawa Field-Naturalists' Club:

LADIES AND GENTLEMEN,—In presenting the customary annual report your Council has pleasure in stating that the progress of the work during the fourteenth year (which by the unscientific and superstitious might be considered an unlucky period) has been satisfactory, and that the present condition of the Club is very encouraging.

The membership continues in the vicinity of three hundred, which may be considered a very large membership for a purely scientific society

Unforeseen difficulties prevented the Excursion Committee from completing the arrangements for some of the proposed excursions, so that these popular outings were not so numerous as in former years. Two very successful ones were, however, held; the first to King's Mountain on 30th May, and the second to Montebello on 26th June, both being well attended and profitable.

Sub-excursions, or small outing parties, visited many of the neighbouring localities, and not a few more distant places. Of these may be mentioned Wakefield, High Falls, Cassleman, Moose Creek, Chats Falls, Buckingham, Mer Bleue, Aylmer, Kettle Island, Hog's Back, Templeton, Donaldson's Lake, etc. By the Botanical Report it will be observed that some of these localities yielded new plants; in entomology and ornithology many good species were also taken and observed, while the geologists discovered very interesting exposures of different formations.

The winter course of meetings consisted of six soirees; the Council having decided to omit for one year the former elementary, or afternoon lectures. The soirees were held on Thursdays in the lecture room of the Normal School, and the following papers and reports were read:—

1891.

Dec. 17.—The Work of the Geological Survey (President's Address).....Dr. Ells.

1892.

Jan. 14.—Notes on Travel in Japan.....Mr. Harrington.

Jan. 28.—Report of the Ornithological Branch.

Report of the Botanical Section.

A Botanical Excursion to "The Chats"..Mr. R. B. Whyte.

Feb. 18.—A Microscopic Soiree with papers as follows :—

The Microscope in Entomology.....Mr. Harrington.

Petrography .....Mr. Ferrier.

Forms of Animal and Plant Life in Swamp Water .....Mr. Shutt.

Feb. 25.—The Natural History of the vicinity of Lansdowne.....Rev. C. J. Young.

Report of the Entomological Branch.

Parasitic Fungi.....Mr. Lehmann.

Mch. 10.—Water; its properties and functions.....Mr. Lehmann.

The Librarian's Report will show that a number of valuable volumes have been bound, and that many publications have been received.

The OTTAWA NATURALIST, which has been issued regularly, and forms for the year a volume of 214 pages, contains many valuable papers and affords both to our members and to the outside scientific world a useful and appropriate record of the work of the Club.

It is particularly gratifying to state that, notwithstanding the large amount required for the publication of this monthly, the Treasurer's Report will show that there is a satisfactory balance.

In conclusion the Council desires to express its gratitude for the continued enjoyment of lecture and library rooms in the Normal School, and to tender its thanks to Dr. MacCabe, through whose courtesy this accommodation is granted.

Respectfully submitted on behalf of the Council.

W. HAGUE HARRINGTON,
Secretary.

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FAUNA OTTAWAENSIS.

HEMIPTERA.

By W. Hague Harrington.

In the report of the Entomological Branch for 1890 (OTTAWA NATURALIST, Vol. V, 193) it was promised that a preliminary list of local Hemiptera would be published. The collection and study of our species has been of a very limited and fragmentary nature, and the list now submitted (with some reluctance) is correspondingly incomplete. It may, however, serve some purpose as a basis for future study of our many interesting forms, and, as few lists of Canadian Hemiptera have been published, a record of the distribution of the species enumerated. When the Abbé Provancher was publishing the third volume of his Petite Faune Entomologique du Canada, specimens of our Hemiptera were communicated by Mr. Fletcher, Mr. Guignard and the writer, and reference to his work will show that from our material he described several new species, and made a number of additions to his records.

The appearance of the present list, however, has been possible only through the kindly assistance of Mr Van Duzee, of Buffalo, N.Y., who has examined nearly all the writer's collections, and has also furnished a generic arrangement of the Homoptera, and in other ways given valuable aid. In the Heteroptera the check list of North American species published by Mr. Uhler in 1872 has been followed.

The following list contains nearly 200 species, but it only shows how much yet remains to be done before any satisfactory knowledge of our fauna is gained. The references to the relative abundance of the species, and the dates of their appearance, are given from the writer's collection, but in many instances are of small value, as these insects have not been systematically collected, but obtained when the main object of the chase was the capture of Hymenoptera and Coleoptera. The greater part of this collecting has further been in the early summer, when many of the species are immature, and comparatively little in July, August and September, when the mature insects would probably be most abundant. Our Psyllidæ, Aphidæ and Coccidæ have been omitted, for though the species are numerous and important, especially

from an economic standpoint, few have been collected and determined. Let us hope that Mr. Fletcher, whose professional duties bring to his notice many of these destructive forms, may at an early date be able to prepare a preliminary list of the species.

HETEROPTERA.

Scutelleridæ.

Homæmus æneifrons, *Say*. Not common. July.
Eurygaster alternatus, *Say*. Common. May to August.

Corimelænidæ.

Corimelæna atra, *Am. et S.* One specimen.
Corimelæna pulicaria, *Germ.* Abundant. May.

Cydnidæ.

Amnestus spinifrons, *Say*. One specimen.
Canthophorus cinctus, *Pal. Beauv.* Not common. May.

Pentatomidæ.

Perillus circumcinctus, *Stal.* Two specimens. April.
Podisus cynicus, *Say*. Not common.
Podisus modestus, *Dallas*. Abundant. May, June.
Podisus sp. ? Perhaps var. of *modestus*. One specimen.
Neottiglossa undata, *Say*. Common. July.
Cosmopepla carnifex, *Fab*. Abundant.
Mormidea lugens, *Fab*. Common. May.
Euchistus fissilis, *Uhl*. Abundant. May.
Euchistus tristigmus, *Say*. Abundant. May.
Cœnus delius, *Say*. Common. May.
Menecles insertus, *Say*. One specimen. June 16th.
Pentatoma juniperina, *Linn*. Abundant. On pines, etc.
Peribalus piceus, *Dallas*. One specimen.
Banasa dimidiata, *Say*. Two specimens.
Banasa calva, *Say*. Not common. May 24th.
Acanthosoma cruciata, *Say*. Not common.

Coreidæ.

Anasa tristis, *De Geer*. Two specimens several years ago.
Alydus eurinus, *Say*. Not common.

Alydus quinquespinosus, *Say*. Not common. August.

Proternor Belfragei, *Hagr*. (*Tetrarhinus quebecensis*, Prov.) Not common. August

BERYTIDÆ.

Neides muticus, *Say*. Rare. June, July.

Corizus punctiventris, *Dallas*. Not common. May.

Corizus nigristernum, *Sign*. Common. August.

LYGÆIDÆ.

Nysius thymi, *Wolff*. Abundant. May, June.

Ischnorhynchus didymus, *Zett*. Abundant. May to July

Cymus angustatus, *Stal*. Abundant. June.

Ligyrocoris sylvestris, *Linn*. Not common. August.

Pamera bilobata, *Say*. One specimen.

Ptochiomera sp.? One specimen.

Salacis pilosula, *Stal*. Two specimens.

Trapezonotus nebulosus, *Fall*. Not common.

Peritrechus fraternus, *Uhl*. One specimen.

Eremocoris ferus, *Say*. Not common.

Scolopostethus affinis, *Schill*. Two specimens. April

Megalonotus unus, *Say*. (?) One specimen.

Peliopelta abbreviata, *Uhl*. Abundant. June, July.

Lygæus Kalmii, *Stal*. Common. July. On Asclepias.

CAPSIDÆ.

Trigonotylus ruficornis, *Fall*. Two specimens. July.

Miris affinis, *Reut*. Not common. April, May.

Leptopterna dolobrata, *Linn*. Common. June, July.

Trachelomiris (*Collaria*) Meillcurii, *Prov*. Common. July.

Resthenia insitiva, *Say*. Not common. June, July.

Resthenia insignis, *Say*. Two Specimens. June.

Lopidea media, *Say*. Not common. June, July.

Phytocoris eximius, *Reut*. One specimen.

Phytocoris pallidicornis, *Reut*. Two specimens. July 14th.

Calocoris rapidus, *Say*. Abundant. June.

Pycnopterna amœna, *Prov*. (Petite Faune Ent. III., 114, n. sp.)

Lygus pratensis, *Linn*. Abundant. April, June.

Lygus flavonotatus, *Prov.* Abundant.

Lygus sp. (Not described.) One specimen.

Coccobaphes sanguinarius, *Uhl.* Not common. July.

Pœcilocapsus lineatus, *Fab.* Abundant. June.

Pœcilocapsus goniphorus, *Say.* Very common. June, July.

Pœcilocapsus affinis, *Reut.* (Prov. Petite Faune Ent. III., 123.)

Pœcilocapsus marginalis, *Reut.* (Prov. ibid.)

Systratiotus americanus, *Reut.* Two specimens. August.

Camptobrochis grandis, *Uhl.* Two specimens.

Capsus ater, *Linn.* Very common. June.

Monalocoris filicis, *Linn.* One specimen. May 24. (High Falls.)

Pilophorus bifasciatus, *Fab.* One specimen.

Stiphrosoma stygica, *Say.* One specimen.

Labops hesperius, *Uhl.* Abundant. June. (Long-winged form rare.)

Idolocoris famelicus, *Uhl.* Not common. May, July.

Idolocoris agilis, *Uhl.* One specimen.

Rhinocapsus Vanduzei, *Uhl.* Two specimens, June 25.

Agalliastes sp. (near *associatus.*) Two specimens.

ACANTHIIDÆ

Tetraphleps canadensis, *Prov.* One specimen.

Anthocoris musculus, *Say.* One specimen.

Acanthia lectularia, *Linn.* Abundant in some localities.

TINGITIDÆ.

Acalypta Thomsonii, *Stal.* One specimen.

Corythuca arcuata, *Say.* Common.

Gargaphia tiliæ, *Walsh.* Abundant.

Physatochila plexa, *Say.* Two specimens.

Leptophya mutica, *Say.* One specimen.

ARADIDÆ.

Aradus æqualis, *Say.* (Prov. Petite Faune Ent. III., 165.)

Aradus acutus, *Say.* (Prov. ibid., 166.)

Aradus rectus, *Say.* One specimen.

Aradus sp. Several specimens of 3 or 4 species.

Aneurus inconstans, *Uhl.* Two specimens. May.

219 Pupa contracta, Say.
220 " Holzingeri, Sterki.
221 " simplex, Gould.
222 " milium, Gould.
223 Vertigo ovata, Say.
224 " Gouldii, Binney.
225 " Bollesiana, Morse.
226 " ventricosa, Morse.
227 " pentodon, Say.
228 " curvidens, Gould.
229 " Binneyana, Sterki.
230 Ferussacia subcylindrica, L
231 Succinea aurea, Lea.
232 " avara, Say.
233 Succinea Hawkinsi, Baird.
234 " lineata, Binney.
235 " Nuttalliana, Lea.
236 " obliqua, Say.
237 " Oregonensis, Lea.
238 " ovalis, Gould.
239 " Haydeni, W.G. Binney
240 " rusticana, Gould.
241 " Verrilli, Bland.
242 Onchidium Carpenteri, W. G. Binney.
243 Onchidella borealis, Dall.
244 Carychium exiguum, Say.

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ROYAL SOCIETY OF CANADA.

The Eleventh Annual Meeting of the above Society will be held in Ottawa in the beginning of June.

Fellows and Delegates will register in Dr. Bourinot's office in the House of Commons on May 31st, between the hours of 9 and 10 o'clock a.m. There will be a general meeting of the Society from 10 to 12 and at 3.30 p.m. The Presidential Address will be delivered by the Rev. Abbé Laflamme, D.D.

The meetings of Section IV—Geological and Biological Sciences—will be held in one of the Committee Rooms of the House of Commons. All meetings are open to the public, and our members are particularly invited to attend. Mr. F. T. Shutt, M.A., F.I.C., F.C.S., our First Vice-President will represent the Club officially.

PARASITIC FUNGI.

By Adolph Lehmann, B. S. A.

(Read at Microscopical Soiree, No. 2, 25th February, 1892.)

One of the many branches of science which is almost exclusively dependent on the microscope for its development, is Mycology or the study of that group of minute plants known as fungi.

This group is an exceedingly large one and, as might be expected, some of its members vary considerably in size and appearance; even more so than some of our forest trees differ from the herbaceous plants growing underneath them. A few like the mushrooms and toadstools are comparatively large; but the number of these compared with those invisible to the naked eye is so small that if the average size of the fungi could be ascertained this would not be materially increased by the former. Therefore, speaking of the group, we call it one of microscopic plants; or plants of which even the outline cannot be seen without a microscope.

In addition to great differences in size, very varied forms of structure and reproduction are found in this group; but one of the characteristics the fungi have in common is that they do not possess the peculiar green colouring matter, called chlorophyll, by which other plants are enabled to transform water and the carbonic acid of the atmosphere into starch or some closely allied compounds. Not being able to do this they must absorb them from other plants or animals or some of their products. They are, therefore either parasitic or saprophytic; the former if they draw their nutriment from living tissues, the latter if from their remains.

Nearly all the fungi have numerous slender filaments ramifying through the material on which they live. Generally this is the only portion of the plant existing in its early stage. It grows very rapidly and constitutes what is known as *mycelium*. From it, branches are sent out which, either directly or indirectly, produce minute reproductive cells called *spores*. Like the seeds of the higher plants, these serve the double purpose of multiplying and perpetuating the species. Many fungi produce two kinds of spores the one for quickly spreading its growth, the other, a resting spore, able to withstand extremes of climate, for tiding over periods unfavourable to the growth of the parent. Most

spores are very small and are easily carried by the wind, as they float in large numbers in the air. Owing to this, the diseases caused by fungi spread very easily.

One of the simplest fungi is the Yeast plant (*Saccharomyces*). It possesses no mycelium, consisting simply of a single, oval cell. Spores are seldom, if, ever, formed. It reproduces itself by bud ling, *i. e.* by bulging out at some point till the protuberance resembles the parent cell and is separated from it by a wall. To study its growth a microscope magnifying 400 to 600 diameters and an artificially heated slide are necessary. It lives on materials containing grape sugar and has the power of splitting the latter into carbonic acid and alcohol. The manufacturer of beer is largely dependent on this lower form of life, for it transforms the sugar produced from the starch by the sprouting or malting of barley into the alcohol found in beer. But it does not assist man only in the manufacture of beer, wine, cider and other alcoholic beverages or the products, like vinegar, derived from the same; but performs an almost equally important role in the production of "the staff of life." The yeast growing in the dough gives rise to successive little bubbles of carbonic acid gas which retained by the latter till baked causes the rising of the dough and the production of a light and more easily digested bread.

A more typical fungus, the various stages of which are shown in some of the microscopes before you, is the one producing the disease known as "Rust" on the various grains and grasses. This disease, most prevalent in wet seasons on heavily manured soils, is generally first noticed by the appearance of reddish-brown spots on the leaves and stems of cereals, which rapidly multiply till the grain ripens. These spots consist of loosly attached, unicellular, oval, somewhat spiny, reddish-brown spores, which carried by the wind, birds or insects to other places, quickly germinate, producing a mass of mycelium and in turn another crop of similar spores. These successive crops of *uredo spores*, as they are called, continue to be produced till the nutriment in the straw lessened by the ripening of the grain and the growth of the fungus is not sufficient to support a vigorous growth of the latter. The parasite then terminates its growth for the season by the production of a somewhat larger, dark brown, two-celled resting spore seen on the

straw during winter in the form of dark, linear patches ; such as you will find on this sample of straw. Germinating in spring both of the cells may produce short filaments bearing on the points of its several branches small gobular cells known as *sporidia*, easily transported by the wind when detached. Shortly after the leaves of the Barberries have expanded thickened patches, dotted with minute yellow spots, may frequently be seen on them. The yellow spots are clusters of a large number of spores gathered together as chains in cup shaped masses and embedded in the diseased, thickened tissues of the leaf through which the mycelium passes in every direction. These spores produced on the barberry leaf may, after being brought in contact with growing grain or grasses, again produce the red rust. This fungus absorbing the nutriment in the stem and leaves of the grain which would otherwise be stored in the seed, causes the latter, instead of being entirely filled to present a more or less small and shrivelled appearance reducing it sometimes very materially, in weight and quality.

In order to check the development or spread of injurious fungi it is important to know as much about their methods of growth and reproduction as possible. Even the knowledge that a disease is caused by a fungus may be of great value in itself, as this would make us careful to destroy or disinfect, as much as possible such materials on which these organisms might be growing. The thickenings sometimes seen on plum or cherry trees, known as "Black Knot" (caused by a fungus) should therefore not only be cut off but burned. The knowledge that the fungoid growth appearing on the leaves of the potato vines causes later on the rot of the tuber, enables us to fight this enemy before the potatoes are taken out of the ground. Much loss has also been prevented by the discovery that the disease on grains known as Smut, produced by the spores clinging to the seed grain can be overcome by soaking the grain before sowing, in a solution of copper sulphate.

The pleasure to be derived from the study of this group of plants is, therefore, not confined to seeing the beauty and harmony of nature but may be materially enhanced by discovering something of value to the human family. Many of those who use the microscope for recreation or amusement will doubtless find this a study well worth while pursuing.

PRELIMINARY CHECK-LIST OF THE LAND AND FRESH WATER MOLLUSCA OF CANADA.

By Rev. George W. Taylor, Victoria, B.C.

In the March number of the OTTAWA NATURALIST I published a request for information to enable me to compile a complete Check-list of the Canadian Land and Freshwater Mollusca, showing the distribution of each species.

It has since occurred to me that the gathering of records may be made easier by the publication of a *preliminary* list. This is printed herewith. It contains the names of all those species of the occurrence of which in Canada I have fairly reliable information.

It does not, however, lay claim to completeness or even to absolute correctness as far as it goes, for I have in more than one instance allowed names to remain which are most probably synonyms, and I have retained other names because they have appeared on published lists though I suspect the specimens on which such records were founded may have been wrongly identified.

Imperfect though it be the list will serve as a basis for future work, and corrections and additions can be made from time to time.

Of the 244 species here enumerated, 128 (47 Land and 40 Freshwater Univalves, and 41 Freshwater Bivalves) are on record from the Ottawa district; 57 (32 Land and 16 Freshwater Univalves, and 9 Freshwater Bivalves) are of my own collecting in Vancouver Island (19 of these being also on the Ottawa list). The remaining 79 (29 Land and 14 Freshwater Univalves, and 36 Freshwater Bivalves) are from other parts of the Dominion. Probably 20 or 30 others may be added to the list.

CHECK-LIST.

A.—Freshwater Bivalves.

1	Sphærium	sulcatum, Lam.	8	Sphærium	patella, Gould.
2	"	aureum, Prime.	9	"	Vermontanum, Prime.
3	"	solidulum, Prime.	10	"	emarginatum, Prime.
4	"	striatinum, Lam.	11	"	flavum, Prime.
5	"	stamineum, Conrad.	12	"	tumidum, Baird.
6	"	rhomboideum, Say.	13	"	spokani, Baird.
7	"	occidentale, Prime.	14	"	partumeium, Say.

15 Sphærium Jayanum, Prime.
16 " tenue, Prime.
17 " transversum, Say.
18 " secure, Prime.
19 " rosaceum, Prime.
20 " truncatum, Linsley.
21 " lenticulum, Gould.
22 Pisidium Virginicum, Gmel.
23 " Adamsi, Prime.
24 " compressum, Prime.
25 " variabile, Prime.
26 " abditum, Hald.
27 " ventricosum, Prime.
28 " rotundatum, Prime.
29 " occidentale, Newcomb.
30 " ultramontanum, Prime.
31 " sp.
32 " sp.
33 " sp.
34 Unio alatus, Say.
35 " asperrimus, Lea.
36 " borealis, A. F. Gray.
37 " Canadensis, Lea.
38 " cariosus, Lea.
39 " complanatus, Sol.
40 " ellipsis, Lea.
41 " gibbosus, Barnes.
42 " gracilis, Barnes.
43 " lachrymosus, Lea.
44 " ligamentinus, Lam.
45 " luteolus, Lam.
46 " multiplicatus, Lea.
47 " nasutus, Say.
48 " occidens, Lea.
49 " phaseolus, Hildreth.
50 " plicatus, LeSueur.
51 Unio pressus, Lea.
52 " radiatus, Lam.
53 " rectus, Lam.
54 " rubiginosus, Lea.
55 " spatulatus, Lea.
56 " subovatus, Lea.
57 " tenuissimus, Lea.
58 " triangularis, Say.
59 " undulatus, Barnes.
60 " ventricosus, Barnes.
61 Margaritana calceola, Lea.
62 " complanata, Barnes.
63 " margaritifera, L.
64 " marginata, Say.
65 " rugosa, Barnes.
66 " undulata, Say.
67 Anodonta angulata, Lea.
68 " Benedictii, Lea.
69 " corpulenta, Cooper.
70 " Dallasiana, Lea.
71 " edentula, Say.
72 " Ferussaciana, Lea.
73 " fluviatilis, Dillwyn.
74 " Footiana, Lea.
75 " fragilis, Lam.
76 " implicata, Say.
77 " Kennicottii, Lea.
78 " lacustris, Lea.
79 " Lewisii, Lea.
80 " Nuttalliana, Lea.
81 " ovata, Say.
82 " plana, Lea.
83 " Simpsoniana, Lea.
84 " subcylindracea, Lea.
85 " undulata, Say.
86 " Wahlamatensis, Lea.

B.—Freshwater Univalves.

87 Valvata tricarinata, Say.
88 " sincera, Say.
89 " pupoidea, Gould.
90 " virens, Tryon.
91 Campeloma decisum, Say.
92 Bythinia tentaculata, L.
93 Bythinella obtusa, Lea.
94 Somatogyrus depressus, Tryon.
95 " isogonus, Say.
96 Amnicola porata, Say.
97 " pallida, Hald.
98 " limosa, Say.
99 " Cincinatiensis, Anth.
100 " granum, Say.
101 Fluminicola Nuttalliana, Lea.
102 Pomatiopsis lapidaria, Hald.
103 " lustrica, Say.
104 Plurocera subulare, Lea.
105 Goniobasis livescens, Menke.
106 " salicula, Gould.
107 Limnæa stagnalis, L.
108 " ampla, Mighels.
109 " decollata, Mighels.
110 " columella, Say.
111 " lepida, Gould.
112 " megasoma, Say.
113 " palustris, Müll.
114 " catascopium, Say.
115 " emarginata, Say.
116 " caperata, Say.
117 " decidiosa, Say.
118 " Adelinæ, Tryon.
119 Limnæa humilis, Say.
120 " lanceata, Gould.
121 " gracilis, Jay.
122 Physa Lordi, Baird.
123 " gyrina, Say.
124 " triticea, Lea.
125 " ampullacea, Gould.
126 " ancillaria, Say.
127 " Billingsii, Heron.
128 " heterostropha, Say.
129 Bulinus hypnorum, L.
130 Planorbis corpulentus, Say.
131 " trivolvis, Say.
132 " macrostomus, Whiteaves.
133 " bicarinatus, Say.
134 " campanulatus, Say.
135 " opercularis, Gould.
136 " exacutus, Say.
137 " deflectus, Say.
138 " albus, Müll.
139 " nautileus, L.
140 " parvus, Say.
141 " umbilicatus, J. W. Taylor.
142 " Billingsii, Lea.
143 Segmentina armigera, Say.
144 Ancylus parallelus, Hald.
145 " rivularis, Say.
146 " caurinus, Cooper.
147 " fragilis, Tryon.
148 " Kootaniensis, Baird.

C.—Land Shells.

149 Selenites concava, Say.
150 " Vancouverensis, Lea.
151 Selenites sportella, Gould.
152 Limax agrestis, Müll.

153 Limax campestris, Binney.
154 " hyperboreus, Westerlund.
155 Vitrina limpida, Gould.
156 " Pfeifferi, Newcomb.
157 Zonites fuliginosus, Griff.
158 " ligerus, Say.
159 " intertextus, Binney.
160 " inornatus, Say.
161 " cellarius Müll.
162 " nitidus, Müll.
163 " arboreus, Say.
164 " radiatulus, Alder.
165 " indentatus, Say.
166 " minusculus, Binney.
167 " milium, Morse.
168 " Binneyanus, Morse.
169 " ferreus, Morse.
170 " exiguus, Stimpson.
171 " fulvus, Drap.
172 " suppressus, Say.
173 " multidentatus, Binney.
174 Pristiloma Lansingi, Bland.
175 " Stearnsi, Bland.
176 Tebennophorus Caroliniensis, Bosc.
177 " dorsalis, Binney.
178 Ariolimax Columbianus, Gould.
179 Prophysaon Hemphilli, Bld. & Binney.
180 " Pacificum, Cockerell.
181 Patula alternata, Say.
182 " strigosa, Gould.
183 " perspectiva, Say.
184 Patula striatella, Anth.
185 " asteriscus, Morse.
186 Helicodiscus lineatus, Say.
187 Acanthinula harpa, Say
188 Punctum minutissimum, Lea.
189 " conspectum, Bland.
190 Helix aspersa, Müll.
191 " hortensis, L.
192 " fidelis, Gray.
193 " arbustorum, L.
194 " Townsendiana, Lea.
195 " hispida, L.
196 " rufescens, Pennant.
197 " Cantiana, Montagu.
198 " thyroides, Say.
199 " albolabris, Say.
200 " dentifera, Binney.
201 " Columbiana, Lea.
202 " devia, Gould.
203 " Sayii, Binney.
204 " monodon, Rackett.
205 " Leaii, Ward.
206 " germana, Gould.
207 " tridentata, Say.
208 " palliata, Say.
209 " pulchella, Müll.
210 " costata, Müll.
211 " labyrinthica, Say.
212 Pupa muscorum, L.
213 " Hoppii, Möller.
214 " decora, Gould.
215 " corpulenta, Morse.
216 " fallax, Say.
217 " corticaria, Say.
218 " armifera, Say.

PHYMATIDÆ.

Phymata Wolffii, *Stal.* Common. August. On Solidago.

NABIDÆ.

Coriscus subcoleoptratus, *Kirby.* Common. June, July.
Coriscus inscriptus, *Kirby.* Common.
Coriscus propinquus, *Reut.* Not common. May.

REDUVIDÆ.

Sinea diadema, *Fab.* Abundant. August, September.
Diplodus luridus, *Stal.* Common.
Darbanus palliatus, *Prov.* (Petite Faune Ent. III., 182, n. sp.)
Evagoras marginata, *Prov.* (ibid, n. sp.)
Opsicœtus personatus, *Linn.* Not common.
Pygolampis pectoralis, *Say.* One specimen. May 31.

LIMNOBATIDÆ.

Limnobates lineata, *Say.* (Prov. Petite Faune Ent. III., 193.)

HYDROBATIDÆ.

Limnotrechus, n. sp.? One specimen.

SALDIDÆ.

Salda major, *Prov.* One specimen.
Salda deplanata, *Uhl.* One specimen.
Salda sp., probably undescribed. Common. (Hull.)

BELASTOMATIDÆ.

Zaitha fluminea, *Say.* Abundant.
Belostoma americanum, *Leidy.* Very common.

NEPIDÆ.

Nepa apiculata, *Uhl.* One specimen. (Leamy's Lake.)
Ranatra fusca, *Pal. Beauv.* Common.

NOTONECTIDÆ.

Notonecta undulata, *Say.* Abundant in lakes and streams.
Notonecta undulata, *Say.* *Var.* almost white. Not common.
Notonecta irrorata, *Uhl.* Not common. (Hull Brook.)
Plea striola, *Fieb.* Common. (Hull Brook and Canal.)

CORISIDÆ.

Corisa calva, *Say*. Not common.
Corisa alternata, *Say*. Abundant.
Corisa planifrons, *Kirby*. Several specimens.
Corisa Harrisii, *Uhl*. Very abundant.
Corisa trivittata, *Prov*. One specimen.

HOMOPTERA.

CICADIDÆ.

Cicada pruinosa, *Say*. Abundant.
Tibicen rimosa, *Say*. Not common.

MEMBRACIDÆ

Enchinopa binotata, *Say*. Common. August.
Campylenchia curvata, *Fab*. Abundant.
Ceresa diceros, *Say*. Abundant. July, August.
Ceresa bubalus, *Fab*. Abundant. August.
Ceresa subulata, *Say*. (?) (Prov. Petite Faune Ent. III., 338.)
Stictocephala festina, *Say*. (Prov. ibid., 237.)
Acutalis semicrema, *Say*. One specimen.
Entylia sinuata, *Fabr*. Common. June.
Publilia concava, *Say*. Not common.
Cyrtosia vau, *Say*. Two specimens.
Cyrtosia trilineata, *Say*. (? *var*. of preceding.) One specimen.
Cyrtosia ornata, *Prov*. (Petite Faune Ent. III., 240, *n. sp*.)
Atymna castanea, *Fitch*. One specimen.
Thelia univittata, *Harris*. One specimen. July 10.
Telamona unicolor, *Fitch*. Females. Common. July.
Telamona fasciata, *Fitch*. Males. Two specimens.
Telamona reclivata, *Fitch*. Not common.
Telamona sp., near monticola, *Fab*. One specimen.
Carynota mera, *Say*. Not common.
Carynota marmorata, *Say*. Two specimens.
Carynota picta, *Prov*. (Petite Faune Ent. III., 246, *n. sp*.) = *var*. of marmorata?

FULGORIDÆ.

Scolops sulcipes, *Say*. (Prov. Petite Faune Ent. III., 223.)

Cixius pini, *Fitch.* One specimen.
Cixius stigmatus, *Say.* Not common. May.
Oliarus quinquelineatus, *Say.* (Prov. Petite Faune Ent. III., 223.)
Myndus impunctatus, *Fitch.* Two specimens.
Stenocranus dorsalis, *Fitch.* Not common. May.
Liburnia pellucida, *Fab.* Two specimens. May.
Helicoptera vestita, *Prov.* (Petite Faune Ent. III., 221, *n. sp.*)
Otiocerus Degeeri, *Kirby.* (=Coquebertii, *Kirby.* Prov. ibid. 217.)
Lamenia vulgaris, *Fitch.* Not common.
Bruchomorpha oculata, *Newm.* Rare.

CERCOPIDÆ.

Lepyronia quadrangularis, *Say.* Common. July, August.
Aphrophora parallela, *Say.* Common.
Aphrophora saratogensis, *Fitch.* Two specimens.
Aphrophora quadrinotata, *Say.* One specimen.
Philæmus lineatus, *Linn.* Not common. June and July.
Clastoptera proteus, *Fitch.* Abundant. July.
Clastoptera obtusa, *Say.* Common. July.

BYTHOSCOPIDÆ.

Bythoscopus sobrius, *Walk.* Three specimens.
Bythoscopus fenestratus, *Fitch.* Two specimens.
Bythoscopus variabilis, *Fitch.* Two specimens.
Bythoscopus pruni, *Prov.* One specimen.
Pediopsis trimaculata, *Fitch.* One specimen. July.
Pediopsis insignis, *Van Duzee.* Two specimens.
Pediopsis viridis, *Fitch.* One specimen.
Pediopsis subbifasciatus, *Say.* (Prov. Petite Faune Ent. III., 292.)
Idiocerus verticis, *Say.* (Prov. ibid., 292.)
Idiocerus alternatus, *Fitch.* Abundant. May.
Idiocerus pallidus, *Fitch.* One specimen.
Agallia quadripunctata, *Prov.* Common. June.
Agallia novella, *Say.* Not common.

TETTIGONIDÆ.

Oncometopia costalis, *Fab.* Abundant. May.
Oncometopia undata, *Fab.* (Prov. Petite Faune Ent. III., 265.)

Tettigonia hieroglyphica, *Say*. Common. May, August.

Diedrocephala coccinea, *Forst*. Abundant. July, August.

Diedrocephala noveboracensis, *Fitch*. Common. July.

Diedrocephala mollipes, *Say*. Not common.

Helochara communis, *Fitch*. Several specimens. May 24. (High Falls.)

Gypona 8-lineata, *Say*. Not common. July, August.

var. flavolineata, *Fitch*. One specimen.

Gypona quebecensis, *Prov*. (?) One specimen.

Gypona albomarginata, *Woodsworth*. (= Hullensis, *Prov*., Petite Faune Ent. III., 269, n. sp.) Three. June.

JASSIDÆ.

Ulopa, n. sp. ? Common in moss, etc. Collected in November.

Gnathodus punctatus, *Thunb*. Three specimens. May 28.

Cicadula variata, *Fall*. Not Common. July.

Cicadula sexnotata, *Fall*. (?) One specimen.

Scaphoideus immixtus, *Say*. Two specimens. July 8, 11.

Thamnotettix clitellarius, *Say*. Not common

Thamnotettix unicolor, *Fitch*. Two specimens. July 7.

Athysanus plutonius, *Uhl*. One specimen.

Athysanus, n. sp. ? One specimen.

Platymetopius acutus, *Say*. Two specimens.

Deltocephalus Sayi, *Fitch*. One specimen. June 23.

Deltocephalus configuratus, *Uhl*. One specimen.

Deltocephalus debilis, *Uhl*. Two specimens. July 11.

Deltocephalus Melsheimeri, *Fitch*. One specimen.

TYPHLOCYBIDÆ.

Typhlocyba vitis, *Harris*. *Var*. Abundant.

Typhlocyba sp. Common.

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ON THE SEQUENCE OF STRATA FORMING THE QUEBEC GROUP OF LOGAN AND BILLINGS, WITH REMARKS ON THE FOSSIL REMAINS FOUND THEREIN.

By Henry M. Ami, M.A., F.G.S., &c., of the Geological Survey.

(Presented to the Royal Society of Canada by Dr. G. M. Dawson, F.R.S. &c., May, 1891.)

(Abstract.)

The paper dealt with the Geological facts and grounds upon which the Quebec group rested and made it a necessary term in the geological nomenclature of strata in North America, but especially in the Province of Quebec.

The grounds, upon which the separation of the various terranes constituting this natural group was based, as well as the faunal and physical relations of its different members, were pointed out, showing the validity of the existence of such a series of fossiliferous sedimentary strata as that which Sir William Logan had recognized and Mr. Billings so clearly demonstrated early in the "*sixties.*"

The removal of the so-called Hudson River black graptolitic series of shales, etc., which are met with at Quebec City, at the west end of the Island of Orleans, along the Marsouin River, and at many other places in the Province of Quebec—at Norman's Kiln, in the State of New York, and in Penobscot County, Maine, and other places in the United States—from an uppermost position in the Ordovician System—immediately above the Utica, or just below the base of the Silurian System—was absolutely necessary in the light of facts whether palæontological or stratigraphical or in the light of other physical reasons.

The characteristics of this so-called "Hudson River" series of rocks, when studied in the field as well as in closer detail, point clearly to its intimate relation and association with the "Levis" of Sir William Logan's Quebec group. The *Levis* and the *Quebec* formations or terranes along with the *Sillery*, form a group of terranes geologically and geographically closely related, which can be divided and sub-divided

in many instances into definite zones or horizons and smaller subdivisions, all of which were deposited under peculiar conditions such as characterised the lower half of the Ordovician (Cambro-Silurian) Epoch in geology.

It will thus appear that the rocks constituting the *Quebec terrane* (which term has been used and is being adopted by many American geologists as a proper one with which to designate these so-called "Hudson River" rocks) form part and parcel of the original "Quebec Group" of Logan.

The paper went on to refer to the faunas entombed in each of these three divisions, care being taken to exclude from the list of characteristic species—such forms as were not found *in situ* or from the rocks proper of each series—whether from loose pieces or from conglomerates or conglomerate like bands, in order that the possibilities of error in correlation as well as in palæontological or faunal differentiation might be lessened in the problem which like the present one affords such diversity of relations and complicated terms.

The paper is, in fact, a sequel to the writer's contribution read before the Geological Society of America at Washington, last December and published since. (See *Bulletin of the Geological Society of America*, Vol. II., pp. 477-502, plate 20, 1891.) Whilst the latter dealt more particularly with the region about Quebec City—the present one referred to the relations and characteristics of the Quebec Group of Logan and Billings throughout the whole extent of the Province of Quebec and contiguous districts, upon which to base the proofs for the validity and actual existence of such a group or series of terranes in that portion of North America. The equivalency of the term "Canadian Period," or "Canadian Epoch," as used by Prof. James D. Dana and others, is also adduced as further evidence, corroborative of the magnificent work performed by Sir William Logan in elucidating the complex structure of the Province of Quebec—which work with the exception of Sir William Dawson, in several papers and reports—found scarcely any advocate, whilst its factors are based upon principles and data which are as durable as the rocks from which they proceed or with which they are related.

				Terranes.
Ordovician System.	Upper	1. Hudson River, (= Lorraine.)	Trenton Group.	
		2. Utica,		
		3. Trenton,		
		4. Black River,		
	Lower	5. Chazy,	Quebec Group.	Quebec.
		6. Calciferous,		Levis.
				Sillery.

The above table is given to indicate the relations of the various members of the Ordovician (Cambro-Silurian) System in Canada showing the position of the "*Quebec Terrane*" in the lower half of the system instead of being classed or grouped along with the Hudson River (= Lorraine) terrane at the very top of the system as formerly. The exact relations, stratigraphical and palæontological, which exist between the Quebec, Levis and Sillery terranes have yet to be defined. Their sequence and order in the scale of time require further investigations before this interesting fact can be ascertained on which Sir Wm. Logan and Mr. Billings were still actively engaged when called away.

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NATURAL HISTORY OBSERVATIONS.

A form for registering observations of the first and last records in Natural History has just been issued by the Royal Society of Canada. This form has been drawn up by a committee of the Royal Society and distributed to the different Natural History and Scientific Societies throughout the country. Observations are asked for upon certain well-known wild plants in all the Provinces of the Dominion, the time of sowing and harvesting grain and the ripening of wild and cultivated fruits. Then follow the arrivals and departures of birds and the most noticeable meteorological occurrences.

There is no doubt that the Royal Society will gather together by this means most valuable information. It is proposed to have the schedules collected once a year and the results laid before the Royal Society for publication in their annual Volume of Transactions.

OBITUARY.

We regret to have to record the death, on 23rd ult., at Cap Rouge, near Quebec, of the Abbé Léon Provancher, F.R.S.C., a noted Canadian Naturalist, and one of the corresponding members of the Ottawa Field-Naturalists' Club. For many years the Abbé had devoted almost his whole time to the study of the natural history of Canada (especially of the Province of Quebec) and to the publication of the results of his labours. In 1869 he began to issue the "Naturaliste Canadien," the last volume of which, No. XX., was completed in 1891. He also wrote a Flora of Canada, three volumes upon portions of the Insect fauna, a treatise upon the Univalve Molluscs, and several other works. Of the above the most important is the Faune Entomologique, in which are described many new species of insects captured at Ottawa. The types of many of these, and of the other species described by the Abbé, remain in his collection, and we sincerely hope that arrangements will be made by which this collection, which has a special value from that fact, may be deposited in some public institution and may not be either broken up and distributed, or even neglected until destroyed by insects. The Abbé Provancher was born at Becancour, Que., in 1820, and before residing at Cap Rouge was for some years Curé of Portneuf.

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EXCURSION No. 1.—TO KIRK'S FERRY.

The first excursion of the season will be held on Saturday, June 4th, to Kirk's Ferry. The excursionists will leave the Union Depot by the Gatineau Valley Railway at 9.45 a.m., *punctually*, and will be back in Ottawa at 7.30 p.m. This will give the party from 10.45 in the morning until 6.30 in the evening for collecting in this beautiful locality. It is hoped there will be a large attendance of members of the Club and their friends. The Railway Company have promised ample accomodation, and tickets may be obtained at the railway station or previously of any member of the Council, at the following rates :—

Members, adults	50 cents.
" children	25 "
Non-members, adults	60 "
" children	30 "

NOTES ON THE NATURAL HISTORY OF THE BLUE MOUNTAIN, CO. OF LEEDS, ONTARIO

By Rev. C. J. Young, Lansdowne, Ont.

(Read February 25th, 1892.)

Travellers by the Grand Trunk Railway from Montreal to Toronto have possibly noticed the rocky and broken nature of the country they pass through between Brockville and Kingston. This is especially the case in the townships of Escott and Lansdowne and in these townships it is that the subject of the present paper "The Blue Mountain" is situated. The rocky tract referred to is most pronounced in the vicinity of Charleston Lake; it extends thence in a south-westerly direction, and continuing along the River St. Lawrence, helps to form the inimitable scenery of the Thousand Islands. In past years this country was densely timbered with pine and other forest trees, and until the lumberman's axe made its onslaught on these, was, we are told, a veritable wilderness, through which the bear, the wolf and the deer roamed at will. To-day the greater part of the large timber is cut away, and in the more level places the land is cleared and cultivated, yielding some of the finest crops in this part of Ontario. In other parts, where the rocky nature of the soil forbids cultivation, a second growth has sprung up, consisting of pine, hemlock, birch, oak and poplar. Here and there patches of the old woodland remain, where the maple, the elm, the beech, and an occasional oak and hickory flourish in all their pristine vigour. But the pine are mostly gone. Besides the curiously shaped conical hill known as the Blue Mountain some six miles north of the Railway and which according to the Government Survey rises to a height of 360 feet above Charleston Lake, there are several other rocky eminences to the South, towards the river St. Lawrence, reaching an altitude of from two to three hundred feet. The whole of this country is to-day curiously diversified with woods, rocks, swamps and in places excellent farms. But it is the rocky tract known as the Blue Mountain that I am going to speak of. Almost every one now is familiar with the "Thousand Isles;" the portion that remains a wilderness extends for about ten miles on the easterly side of Charleston Lake, and varies from three to four miles in width. To lovers of nature it is a most interesting tract of country. Within these limits there is no cultivation. The larger

timber, as I have stated, has been mostly cut away or destroyed by fires, but its place is taken by the dense second growth of trees above referred to. On approaching from the south, a traveller is at once struck by the extremely broken ground. On this side and on that, huge masses of rock rise up among the trees. Chaos reigns supreme and many a one well acquainted with the country who has gone out in summer to pick berries and has lingered till twilight, has failed to reach home that night. There are deep gullies and chasms between the rocks. The south side of the Blue Mountain proper is very steep, rising in terraces one above another; the outlying ridges contain steep rocky bluffs, in places bare, in others thickly wooded. Between these bluffs are swampy spots, little creeks, or here and there a marsh. In some places the chasms between the rocks are so narrow, though from forty to fifty feet in depth, that a good sized tree that has fallen across, forms a natural bridge. Few except such as are lovers of nature or are fond of romantic scenery, with hunters and berry pickers, visit this spot. The latter are numerous in the summer months, for the ridges, as they are called, abound with blueberries, the gullies with raspberries and blackberries and the small marshes produce very fine cranberries. Near the crest of the highest ridge, running parallel with the large lake below, are two small lakelets, about half a mile long by a quarter wide. The highest of these is a romantic spot, a complete basin among the rocks. On the east side rise abruptly from the water precipitous rocks, to a height of probably a hundred feet, clothed with scrub pine and oak. The water in these lakes is said to be very deep, it is clear and cold, and on a fine day of a lovely blue. The only fish in these lakes is a species of minnow or small chub; speckled trout if introduced, I do not doubt, could thrive well. I should suppose the rugged nature of this district is due to volcanic forces, and those who know the geology of the country better than I do, will say whether it is not altogether probable that these lakelets are the craters of extinct volcanoes. Charleston Lake at the foot of these ridges is now pretty well known. It has been much frequented for some summers past by American tourists, who resort thither for the sake of sport, retirement and the pure air. The salmon trout of this lake are held in much repute, and by those who understand the method of fishing for them, are easily caught in the summer and "fall".

The American visitors are very successful, using a long line and allowing it to sink in the deep water to a depth of upwards of one hundred feet. The rocks to the east and south of the lake are of the Laurentian formation, but contain no economic mineral, at any rate none have been discovered so far. In the lake itself are islands of crystalline limestone, and on the west shore I believe both lead and iron have been found and were formerly worked.

But to return to the Blue Mountain. From its highest part the round conical hill already mentioned, a magnificent view may be obtained on a fine day. Charleston Lake stretches below, at its head is the little village of that name ; a little beyond, the spire of the church at Pine Hill rises amid a grove of pine trees ; to the north-west the eye ranges over a tract of rock and woodland, to the south and east is the river St. Lawrence, the fertile country intervening, and far beyond, the hills in the United States, where the limit of vision is bounded by the foot hills of the distant Adirondacks. Altogether the view is unique in this part of Ontario. But a ramble among these rocks and ridges is very tiring on a warm day, and few would care to undertake it alone.

Formerly as mentioned this region was a great resort for deer, and the older settlers tell how numerous they used to be. But within the last few years they may be said to have disappeared and now only an occasional straggler is seen. Bear too and wolves were formerly numerous ; the last bear that I have heard of was seen four or five years ago by two farmers in the neighborhood, although traces of them have been since seen ; and during the past "fall" three are said to have been met with near the Gananoque water some four miles from Charleston Lake. Wolves were thought to have become extinct, but in October 1887 a large one was poisoned close to the Blue Mountain. A number of sheep had been previously missed, one farmer losing as many as twenty-eight, killed, as was thought for a time, by dogs. In the partially eaten carcase of one of these strychnine was placed and thus the wolf was obtained. The person who captured it, told me of its large size, and the layers of fat he found under the skin clearly proving it had fared well on the farmer's sheep. A second one was suspected of being in the neighborhood; but none have since been seen. The lynx or wild cat, as the settlers call it, is still found among the rocks. Of the

other large mammals the raccoon and fox are plentiful. Two years ago I saw four young silver-grey foxes, captured the previous summer, and which had become quite tame. They probably were the offspring of a cross between the red and black varieties, a specimen of the latter being occasionally seen. An otter is trapped from time to time in Charleston Lake ; I heard of one last year. The porcupine is a common animal, the locality being exactly suited to his requirements. In the heavier timbered places there are a few black squirrels, an occasional grey one, and other smaller animals are plentiful. With the exception of partridges, (the ruffed grouse) and some ducks, game birds are not plentiful. There are plenty of the former, but they are difficult to follow on account of the rough nature of the ground. This year they have fed eagerly on beech nuts. The spruce partridge I have not heard of. Of ducks the black duck (*Anas obscura)* is very common and affords capital sport to those who are fond of hunting them during September and October. During the day time they are often found resting in the little lakes I have mentioned, where they usually find perfect quiet and seclusion. In the evening they fly down to the bays and marshes around Charleston Lake to feed. Of other ducks the wood duck, (*Aix sponsa*) the "fall ducks and broad bills" as they are plentiful on larger waters in October and November, as also the "golden eye," some of which remain all the winter in the open parts of the river St. Lawrence. Of other birds in this district I will mention some of the rarer kinds, which I have noticed myself or heard of during the last three years. The bald eagle nests every year in the township of Lansdowne, near the river St. Lawrence, also near Marble Rock in Leeds. The osprey is a very rare bird and does not appear to nest. I have seen only one. Of hawks, the red-tail passes to and fro in spring and fall, and if it breeds here rarely does so ; the red-shouldered (*Buteo lineatus*) is the commonest of the large hawks and breeds abundantly : I have seen one specimen of the broad winged hawk (*Buteo Pennsylvanicus*) in May last, so it possibly breeds. The other hawks are the sharp-shinned and sparrow, the latter quite common. I should not forget to mention the marsh hawk, which is not uncommon and breeds in the marshes. The eggs of a set I saw in 1890, five in number, were boldly marked and spotted. Of owls we have a

great variety, but none are common, the snowy owl and the great cinereous owl have both been captured in winter near the Blue Mountain, and I have seen specimens, as well as the Virginian horned owl, which is generally distributed but not common. Of the long eared-owl, I saw a specimen shot within a distance of ten miles, in November 1890. The short-eared owl, two specimens procured in the township of Lansdowne in 1890; the screech owl, (*Megascops asio*) caught at Lansdowne in October 1891, which I now have alive; and the barred owl, and sawwhet; a specimen of the latter was caught alive at the river St. Lawrence in June 1890. All these varieties I have seen. Of other birds the white-rumped shrike is common, the northern shrike (*Lanius borealis*) appears every winter. The towhee (*Pipilo erythrophthalmus*) is a common bird, hatches in June. I found the nest with four eggs, May 19, '91. I noticed a pair of morning doves, (*Zenaidura macroura*) in April 1891, in the township of Lansdowne. The flycatchers are common. I noticed a nest of the wood pewee, (*Contopus virens*) on a horizontal branch of a beech tree in June last, and in the same grove also on a beech tree obtained a nest of the ruby-throated hummingbird. Of warblers the rarest I have seen is the "mourning," of this I watched a nest with four eggs in June 1891. In marshy districts around Charleston Lake the long-billed marsh wren is very common, breeding in all suitable locations; the winter wren occasionally breeds, and in 1890 I found a nest in a rotten stump close to the ground; not ten yards from the tree on which the bald headed eagle nests, a striking reminder of the frequent proximity of majesty and insignificance. Of water fowl, the favourite haunts of these birds are so numerous, that it would be strange if there were not a fair variety. The bittern, the great blue heron the green heron, I think, though not quite sure, the black and wood ducks, the coot, the horned grebe, (*Colymbus auritus*) all breed in the Blue Mountain district, as too the woodcock, a nest of which species with three eggs, I saw in June 1890; the Virginia rail, nest with nine eggs June 17th 1891 and the kildeer plover. A nest of Bartram's sandpiper was found in an upland meadow in 1889 with eggs and it is probable that the solitary sandpiper also breeds, as I have seen the old birds as late as June and as early as August. Of other birds I am assured by a person who has travelled in the North West, that he saw a flock of sand

hill cranes pass over the township of Escott in 1890, and recognized the birds by their cry. In the present month December 1891, I have seen two wax wings, (*Ampelis garrulus*). Space does not permit me to go further into an account of the birds, as I must mention some of the more striking plants. The rarest plant I have met with is the dwarf sumach, (*Rhus copallina*) found by me about a mile inland from the river St. Lawrence in October last in the township of Lansdowne. The bright red foliage of the plant at that time of year formed a noticeable feature. I understand it has only been found once before in Canada on an island in the St. Lawrence river near Brockville. I enclose a leaf. In the same locality I find the pitch pine, *Pinus rigida* to be a common tree growing in suitable places, *i.e.* rocky ground on the islands in St. Lawrence and north, on and around the Blue Mountain. The red cedar is also a common tree here, growing in this section of country invariably as far as I have observed, on and among Laurentian rocks. Time forbids me to go into any systematic mention of other plants, but I will speak of a few at haphazard, which friends at Ottawa have kindly named for me. The closed gentian, (Gentiana Andrewsii) is fairly common from the St. Lawrence northward in moist meadows. On the borders of creeks and near the river, the ground nut, (Apios tuberosa) is a common plant. Near the Blue Mountain I met last May with pretty blossoms of the fringed polygala, (Polygala paucifolia). On the Islands among rocks as too on the Blue Mountain. I have met with the enclosed fern, a southern variety I think, (*Asplenium ebeneum.*) The mandrake, (Podophyllum peltatum) is very plentiful in places on the islands, and the little plant 'Pyrola elliptica' (enclosed) grows among the rocks. The ginseng, recently so much sought after, has been frequently found in the vicinity of Charleston Lake. We have several other plants to which I might call attention as met with in this locality, but I must pass them by now, hoping on another occasion to give a more systematic list of some varieties not commonly found. I cannot but add in conclusion that some knowledge of the '*fauna*' and '*flora*' of the country districts of Ontario and where we happen to live, is to my mind both edifying and instructive. The field is wide and diversified here in Ontario, a comparatively short distance shows great variety of soil and natural features, to a certain extent even of climate. There are few who amid the pressure

of daily life, when following their avocations, but can spare a day or part of a day now and again to watch the workings of God in nature, and acquaint themselves with his works. In a comparatively new country there may be for a time but few who thus care to spend any spare hours they may happen to have ; but these few will increase. I seldom meet with a kindred spirit though no doubt such are on the increase; but I feel sure that such an institution as the Ottawa Field-Naturalists' Club seems to be, is best calculated to produce a sentiment of love for nature, and a yearning for knowledge of those things which are placed within the reach of most of us.

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EXCURSION No. 1.—TO THE CASCADES OF THE GATINEAU.

The first excursion of the season was held on Saturday, June 4th, and was one of the most successful that has ever taken place under the auspices of the Club. Amongst those who availed themselves of this opportunity to visit the beautiful Gatineau Valley were several members of the Club who live at a distance, but who were in Ottawa either attending the meeting of the Royal Society of Canada or the session of Parliament.

A large and happy party of excursionists left the Union Station at 9.45 a.m. by the new Gatineau Valley Railway, and ascended that wild and important tributary of the Ottawa, which rising away in the far north beyond the head waters of the Ottawa itself, flows almost due south from its source and joins the Grand River at right angles to its course a mile below the city. Everything conspired to make the trip pleasant, the weather was simply perfect. Old Sol shed his genial warmth over the fresh spring landscape, the air was clear but there was no rain, a grateful coolness pervaded the broad and beautiful valley up which the railway winds its way. The run from Ottawa to the Cascades was delightful and refreshing. The cars were new and clean, there was no dust, and above all, there were no mosquitoes,and the railway officials were most attentive and courteous. From the time Hull and the Can-

adian Pacific Railway track were left behind and the party entered the valley of the Gatineau, a varied and constantly changing panorama of great beautywas unrolled before the eyes of the appreciative excursionists. The numerous curves necessary in carrying a road through a mountainous country showed to great advantage the rounded hills covered with their copious mantle of tender green. The delicate tints of the Aspen the Sugar Maple and the Beech contrasted well with the dark foliage of the evergreens, Pines, Firs and Spruces; which again was varied by the differing shades of other trees and plants, and with the foaming torrent rushing below made a landscape of marvellous magnificence and Leauty. Leaving Hull and passing through the rich farm lands which lie amongst the hills, the road runs past Ironsides and then on to Chelsea, rising at first gradually and then quickly from terrace to terrace until at the latter place the old Laurentian Hills are entered with their characteristic scenery. The railway skirts the edge of the river and gives many a glimpse of rushing rapids, weather-stained rocks, hill-side and crag scenery. Kirk's Ferry and its foaming waters were passed. This was the original objective point of the party, but as the sky appeared to be rather overcast and as the railway company had put a special train at the disposal of the Club, it was deemed wiser to run on as far as the Cascades, and at the end of the day everyone was much pleased that this change had been made. The Cascades, about fifteen miles from Ottawa, was reached at half-past ten, when Mr. Frank T. Shutt, M.A.,F.I.C.,F.C.S., Acting President of the Club in the absence of Dr. George Dawson, C.M.G., F.R.S., &c., (who is now in England as arbitrator and adviser with the Imperial authorities on the Behring Sea matter) having formally welcomed all present in the name of the Club, announced the programme. The following gentlemen acted as leaders for the day in the various branches of study:

Geology—Dr. H. M. Ami, Dr. R. W. Ells, Prof. Bailey (Fredericton, N.B.).

Botany—Mr. R. B. Whyte, Prof. Macoun, Mr. W. Scott.

Entomology—Rev. Dr. Bethune (Port Hope, Ont.).

The party then broke up into small bands and went off with the leaders to seek for treasures in this new field of work. Everyone found something of interest, and many of the visitors who had only come on

the excursion for the day's outing, saw for the first time some of the charms in the study of the glorious creation around us, which make naturalists, as a class, the happiest and most contented of mortals.

At 13 o'clock (1 p.m. old fogy time) there was a general rally at the rendezvous when the inner man was refreshed. After luncheon the botanists and geologists united their forces and a visit was paid to the mica mine. The way was rough and hard but the reward was declared to be ample by all who took the trouble to climb to the pits. There were several of these, and mica was seen strewn around in large quantities, besides many other minerals of interest. Apatite, pyrites, pyrrhotile, pink calcite, pyroxene in crystals, as well as gneisses and other rocks.

At 17.30 Mr. Shutt summoned the party to the railway station and announced that the leaders would deliver short addresses upon the results of their day's work. He congratulated those present on the success of the excursion, and in a few well chosen and happy words introduced each speaker. Dr. Henry M. Ami was first called upon. He spoke in his usual pleasant and earnest manner on the minerals and geological specimens he had collected, which he exhibited, and also on the points of interest in the past history of the locality. He drew attention to the origin, nature, composition and use of the minerals met with and gave a sketch of the geological formations between Ottawa and the Cascades.

Dr. Bailey, Professor of Geology in New Brunswick University, Fredericton, N. B., followed Dr. Ami, and in a pleasant manner expressed his gratification at being present. He had been a member of the Ottawa Field-Naturalists' Club for many years, and was proud of belonging to it, as he was satisfied it was the most active and live society of the kind on this continent. He then gave some graphic notes on the theories regarding the rocks which were seen during the day.

On behalf of the entomological branch, the Acting President invited the Rev. Dr. Bethune, the well-known and talented editor of the "Canadian Entomologist," to speak. He also expressed his great pleasure at being present and meeting his fellow-members of a club which he had joined some years ago because he knew that it had good workers in its ranks, and was therefore doing good useful work in all branches

of natural history. The present day, although very pleasant, had not been bright and sunny enough to tempt a large number of insects from their hiding places. Dr. Bethune spoke in a charming manner of such insects as he had captured, and all present were interested in his explanations of their life-histories.

Mr. Robert B. Whyte was then called upon to speak on the plants collected. As one of the oldest members of the club, as well as one of our best and most enthusiastic botanists, Mr. Whyte is always eagerly listened to, and all were much disappointed when his interesting account of the many treasures he had gathered, was summarily cut short by the appearance of the train and the conductor's word of command "All aboard.' The success of the day was attested by the frequently expressed wish that the day had been longer, and the Excursion Committee has been requested to arrange another excursion by the Gatineau Valley Railroad as soon as practicable.

The city was reached at 19.30, the advertised time, and the party was met at the station by a string of electric cars, which in a few minutes took all to their respective parts of the city.

All present expressed themselves as delighted with the day's outing, and a vote of thanks was passed to the railway authorities, and especially to Mr. J. T. Prince for the facilities and attention given to the members of the Club.

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SUB-EXCURSIONS.

SUB-EXCURSION NO. 1—TO ROCKCLIFFE.

The club began its field work this season on May 14, when a party of about forty members and their friends took the electric cars to New Edinburgh and examined the woods lying round Hemlock Lake. Leading the Geological branch were Dr. H. M. Ami and the Hon. Pascal Poirier. Mr. R. B. Whyte lead the Botanists, and Mr. Kingston the Ornithologists.

The weather was exquisite and the woods, although the buds of the trees had not yet expanded, were ablaze with lovely spring flowers. The wistful Hepaticas peeped out from behind rocky points on Rockcliffe, and the modest Spring Beauty brightened the deeper shades of the groves. The Adder's-tongue Lily and Trilliums, red and white, held their heads erect in the welcome sun-light. Violets coy and the too-retiring Wood Daffodil or Bell-flower, together with the Wood Mignonette (*Tiarella*) and stalwart Blue Cohosh, as well as many other woodland beauties, all opened wide their blossoms to welcome their admirers. The soft downy twin leaves of the Wild Ginger with their single handsome purplish flower, were found by those who sought vigilantly for this attractive plant, and *Daphne Mezereum*, which has become established in the woods, probably from seeds dropped by birds, added a peculiar charm to the shrubbery with its bright pink blossoms. The beauties of all these were pointed out by Mr. Whyte, and their structure and classification explained.

Mr. Kingston spoke of the birds seen or heard, and announced to his audience the arrival of the latest summer visitors.

Dr. Ami spoke on the rocks and fossils collected, pointing out their age and also the nature and origin of Hemlock Lake and the surrounding district.

SUB-EXCURSION NO. 2.—TO THE BEAVER MEADOW, HULL.

A small party of about a dozen members visited the Beaver Meadow, Hull, under the leadership of Dr. Ami and Mr. T. J. MacLaughlin, on 21st May. Amongst the plants collected *Orchis spectabilis* and *Camptosorus rhizophyllus*, the Walking Fern, were the most interesting. Although the day was propitious, not many insects of rarity were secured.

OTTAWA FIELD-NATURALISTS' CLUB

Treasurer's Balance Sheet, 1891-92

RECEIPTS

1891.			
March 18—To balance from previous Club year			$ 15 12
1892.			
March 18—To Subscriptions :			
	Arrears of previous years	$ 36 00	
	Current year 1891-92	163 00	
	Paid in advance for 1892-93	6 00	
			205 00
" Advertisements			41 00
" " Naturalists " sold			9 35
" Received for Authors' " Extras "			27 65
" Net proceeds Excursion to Kingsmere 30 May '91			11 55
			309 67

EXPENDITURE

1892.			
March 15—By Ottawa Naturalist, Vol V.,		$225 97	
" Postage on same		10 75	
			236 72
" General postage			7 38
" " printing and stationery			4 60
" Cost of Authors' " Extras "			25 05
" Gratuity to Janitor Normal School			5 00
" Expenses of Soirees			2 20
" Balance on hand			28 72
			309 67

Audited and found correct A. G. KINGSTON,
Ottawa East. April 4th, 1892. *Treasurer.*
J. BALLANTYNE,
WM. A. D. LEES,
Auditors.

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EXCURSION NOTICE.

An excursion will take place on Saturday afternoon, July 9th, to Casselman by the Canada Atlantic Railway. This is a most interesting locality, and very satisfactory rates have been received from the railway company. The excursion will leave the Elgin St. station by the 2.15 train, and the party will reach Ottawa again at 8.30 p.m. Tickets may be obtained from any member of the Council before leaving, or upon the train, at the following rates :

Members of the Club	40 cents.
Children under 12	20 "
Non-members	50 "
Children under 12	25 "

SOME OF THE PROPERTIES OF WATER.

By Adolph Lehmann, B.S.A.

(*Delivered March 10th, 1892.*)

In addition to being one of the most widely distributed substances known to us, Water is one of the most valuable compounds. Without it life from the highest to the lowest forms would be impossible. Owing to its solvent action it is the carrier of plant life in the soil. It enables transformation and translocation of materials in the tissues of all living bodies, enabling them to grow. It plays a part in the electric currents of the atmosphere, and acts as a most powerful equalizer of the climate of our globe. It is one of the principal factors in the formation of soils; and has at the same time assisted in the production of many of the rock formations. It is a purifier of the atmosphere. In short it may be considered as a balance-wheel of nature.

Having such useful and varied functions to perform, it would doubtless be interesting to study its properties, even if they were the most simple; how much more so is this the case when they are, as we find them, very varied and manifold, giving ample room for study and thought.

Water exists in different forms and locations. In addition to the vast expanse of oceans, lakes and rivers in the Torrid and Temperate Zones, and the plains of ice and snow to the north and south of these, it is present in varying percentages in nearly all organic substances. It can be detected in apparently perfectly dry paper or wood. Hay, straw, and the various grains contain in the neighborhood of 10 per cent. We find it also in some perfectly dry crystals, which without this "water of crystallization," as it is called, would fall into powder. It may be interesting to note that while milk (a liquid) contains about 87 per cent. of water, cucumbers and melons (solids) are made up of 95 per cent. of this compound. The difference is that in the former the solids are largely held in solution, while in the latter they form tissues to enclose the water—as it were a mass of minute sacks, called cells, filled with water. Since it is incompressible it helps to prevent cells from collapsing which, having thin walls, they would otherwise be liable to do. The water in succulent fruits or other parts of the plant

therefore makes them firmer rather than otherwise, as is clearly demonstrated when a portion of the water is removed as in fading.

In addition to snow, ice, and ordinary water, an invisible form exists in nature as vapour suspended in the atmosphere, or as steam enclosed in the boilers of our engines.

These three forms of aggregation—solid, liquid and gaseous—have of course the same composition; but, as we know, vary in appearance and properties. They are easily transformed one into the other, and frequently exist in nature in contact with each other. Although easily accomplished this transformation is not so simple as, without reflection, we might suppose. If a thermometer be placed in contact with melting ice, it will always indicate the same temperature no matter what the heat applied to the ice may be, and furthermore, so long as any of it remains in contact with the resultant water, this also does not vary, but remains constantly at the freezing point. Since neither the ice nor the water have increased in temperature the heat applied to them is not indicated by the thermometer, and is hence called *latent heat.* Heat, as we know, can be transformed into force, and in this case it has it has been used to overcome the force which holds the minute particles (called molecules) of which the ice is composed, in their place, preventing them from moving past each other as they do in liquids. The heat necessary to do this work can be measured by applying a definite amount (in the shape of hot water) to a pound of ice. If we were to mix a volume of water at 80°C. (176°F.) with the same weight of ice at its melting point, and could prevent the loss of any heat, we should find that after a time the ice would have disappeared, and two volumes of water at the freezing point would be the result; clearly showing that considerable heat had been rendered latent.

Very frequent use is made of this property of water, as for example in "freezing mixtures." In these the heat required to melt the ice is supplied by the materials to be cooled or frozen. A convenient form is that in which this material (i.e., a can of cream) is imbedded in a mixture of salt and ice. Since salt is very soluble it can cause the ice to melt at a much lower point than it generally does, thereby materially reducing it in temperature. In the construction of the scale for his thermometer Farenheit used the lowest point obtainable by this mix-

ture as the beginning, while both the other makers used the freezing point as their zero.

In the transformation of water into steam a very much greater amount of heat is consumed (about 6½ times as much) than by melting ice. This is illustrated to some extent by the comparatively long time required to vaporize water after it has reached the boiling point. Since the steam generated has the same temperature as the water from which it has been formed, the length of time required to vaporize the latter compared with that necessary to bring it to the ebullition point indicates to some extent the heat rendered latent. If this latent heat in steam did not exist we should be unable to use boiling water, as at present, for the preparation of our food; for as soon as it had reached this point it would immediately vaporize to be almost instantly deposited again as water on the somewhat cooler materials with which it would come in contact.

Although the boiling point like the freezing point serves as a standard in the manufacture of thermometers, it is not constant under all circumstances. On the top of mountains it is much lower than at the sea level; in fact so material is this variation that comparatively small differences in altitude can be determined by it. Thus it may be made to partially serve the purpose of a barometer; for, like the height of the mercuric column in that instrument, its height is dependent upon the weight of the atmosphere. That by an increased pressure this point is also increased is often seen in the boilers of steam engines; and that low pressures have the opposite effect is strikingly illustrated by numerous simple experiments. If, for example, a flask containing some water be heated till it is entirely filled by steam and the residual water, and then tightly corked, the water in it can be made to boil by cooling the flask. The steam being condensed the pressure would be reduced and the vapour developed finding less resistance could pass through the water to the surface and cause what is known as boiling. Water contained in a tube enclosing a partial vacuum can reach this stage when heated by the hand.

The temperature at which water, or rather watery solutions, disengage steam, is, in addition to pressure, considerably influenced by the nature and quantity of the materials dissolved. Many gasses reduce

and solids increase it. A saturated solution of salt boils at 102°C., and one of calcium chloride at 179°C.

Several other factors have been noticed to influence the boiling point, e.g., the quantity of water used and the material composing the vessel in which it is heated. Single drops of water suspended in other liquids have been heated many degrees above this point before they suddenly transformed into a volume of steam. In a perfectly clean glass vessel, water has been heated to 106°C. before ebullition commenced. Together with the first bubble, however, sufficient steam was generated to reduce the temperature to the normal boiling point. This cause of "bumping" may be overcome by placing a piece of metal in the bottom of the flask.

The value of water as an extinguisher of fire is partially dependent upon the large amount of of heat absorbed when transformed to steam and partially upon the fact that it serves to prevent the oxygen of the atmosphere from coming as readily in contact with the burning material. Combustion of such substances as wood and coal is dependent on their union with oxygen, and this does not take place to such an extent as to cause what is known as burning, unless they are heated to a considerable degree.

Although taking place more quickly when boiling, we know that water can evaporate at any temperature between the boiling and the freezing points, in fact considerably below the latter. Ice will evaporate on a cold winter day as clearly shown by clothes drying at such a time. We might therefore be almost justified in saying that we could boil ice. This term is, however, only applied to liquids, and only when the vapour is formed throughout the mass and rises as bubbles to the surface. When this is not the case we speak of liquids as evaporating and solids as volatilizing. The singing noise sometimes heard in water shortly before it reaches the boiling point is produced by the formation and subsequent collapsing of bubbles of steam.

As in melting ice, the heat rendered latent in vaporization is expended in changing the relation of the molecules to each other. These are much further apart in steam than in water. One volume of the latter would occupy nearly 1700 volumes when converted into the

former by boiling, at the ordinary pressure of one atmosphere. If, however, half this weight be removed the steam would occupy double the space. Therefore we say that steam is elastic. But it is not so to an unlimited extent; for if, instead of diminishing, we were to increase the pressure a large portion of the steam would be converted into water. That is to say, the tension of steam at 100°C. or its power to withstand pressure, is equal to one atmosphere (the weight of a column of air from the sea-level to the limit of the atmosphere, equivalent to the weight of a column of mercury of the same diameter 760 mm. high). Steam heated to a higher temperature (as can be done in the boilers of steam engines) can resist a greater force before being converted into water. It is, therefore, able to do some work in addition to resisting the atmosphere. If cooler than 100°C. its tension is less than that necessary to resist the atmosphere; and, therefore, being unable to entirely resist it, the steam must be mixed with the air (in proportion depending on the temperature) if it is to remain uncondensed. The cooler it is, the greater the proportion of air mixed with it must be; or, since the temperature of the steam and the air are the same, we may say the cooler the air the less aqueous vapour it is able to hold.

When air is completely saturated with vapour, it is said to be at its *dew point*. If subsequently cooled, a portion of the vapour will separate; if heated, it can absorb still more. This we find frequently illustrated in nature. A glass of cold water brought into a warm room frequently condenses a film of water on its surface. During cold weather dew is often deposited from the atmosphere of the warmer room on the windows. Clouds and fogs, which consist of minute drops of water too small to fall to the ground, are produced by a warm current of air laden with moisture coming in contact with a colder one, lowering its temperature below the dew point. That the clouds surrounding the peaks of mountains appear to remain there permanently, notwithstanding that a slight wind may be blowing, is due to the cold atmosphere produced by the ice, snow, or glaciers being confined to narrow limits. The warm air striking these produces a cloud which disappears when the warmer region is again reached; for the drops of water being once more evaporated become invisible like aqueous vapour always is.

The minute drops of water in the clouds, if gathered together into

larger ones, replace, by the formation of rain, hail or snow, the evaporation continually taking place at the earth's surface. At the same time it removes some of the moisture from the atmosphere. Thus the variations in temperature, in addition to supplying us with rain and the beneficial results following it, viz., the purifying of the atmosphere from dust and various gasses, returning to the soil the fertilizing materials expended in the atmosphere, and feeding the springs and rivers, and furnishing the higher lying districts with water; they also serve to prevent the air from being at all times at its dew point.

As has been mentioned water has a great power to act as an equalizer of climate. By its evaporation during the day it has a powerfully cooling influence. This is easily observed when comparing the refreshing coolness of a lawn, which is largely due to the moisture evaporated by the grass, with bare streets and sandy plains. In addition to this cooling influence, which is the greater the warmer the day, vapour has a tendency to preserve the heat during the night, as it acts as a mantle or blanket to the earth, preventing the too rapid radiation of the heat absorbed during the day. The rapidity with which the thermometer drops during a clear star-light night, when the vapour has been partially deposited as snow or rain or drifted by the winds to other parts of the globe, is frequently observed when compared with what takes place on cloudy nights.

But the water, as such, acts also as an equalizer of temperature. We find that some materials do not increase in temperature as rapidly as others when exposed to the same source of heat; i.e., some do not vary as easily as others, notwithstanding that they may absorb the same quantity of heat. This is easily seen when comparing the rapidity of increase in temperature of dry sand with that which has been previously moistened; or water with iron or some other metal when exposed to the heat of the sun. The metal and the dry sand become warm much more quickly than the wet sand or the water. Yet, making allowance for the evaporation of water and the quantity of heat reflected from them, the water, though very much colder, will have absorbed the same quantity of heat as the other materials and can again transmit it to cooler bodies. Thus during the day, more especially during the summer months, it absorbs the heat of the sun and liberates it again at

night, or during the colder part of the year, at the same time remaining itself comparatively uniform in temperature. Even a small lake frequently protects plants growing on its shores from injury, while those at some distance may be killed by an early autumn frost. The larger the body of water the more marked its equalizing influence will be, and the greater the extent of country benefited by it.

Generally bodies expand with heat and contract with cold. Water is no exception to this rule at the higher temperatures, but when below 4°C. it acts exactly opposite to this law. At this point, therefore, it has its maximum density, i.e., is heavier than at any other temperature. by this property water is still further preserved from variation, for the heaviest portion (that nearest 4°C.) will remain at the bottom where it is protected by the layers overlying it.

A popular impression is that, owing to this peculiarity of water rivers and lakes are prevented from being frozen solid to the bottom in winter. Although, in addition to the high specific heat of water, it doubtless helps to prevent this, the principal cause is to be sought for in the properties of ice. During its formation it expands very considerably and, therefore, occupying more space than the water is lighter than it and floats on the surface. Being a bad conductor of heat it serves as a mantle, retarding very materially the action of the cold atmosphere on the water. That ice occupies more space than water is shown by the fact that when water is allowed to freeze in pipes or other vessels they are very frequently broken by it. The heaving of fence posts and, to some extent, the bad roads in spring are also indications of this property. Although doubtless sometimes doing considerable injury this expansion of water when solidifying has been of immense value in the formation of soils.

Ice follows the general law of expanding with heat and contracting with cold. The rolling, thundering noise sometimes heard on large planes of ice, when the temperature is falling is caused by the contraction and subsequent cracking of ice. The fissures being filled with new ice, the plane, on the advent of warmer weather, expands increasing in area. The force with which this takes place is very considerable, as frequently large stones are moved and heavy timbers broken by it.

As the melting point of ice is always the same under ordinary

conditions, so the freezing point remains constant under similar conditions. But if water be subjected to pressure or kept entirely undisturbed it can be cooled considerably below the temperature at which it generally solidifies. A like result is said to follow if it be exposed in fine capillary tubes. As soon as the pressure is removed or the water disturbed, ice forms very rapidly, the water at the same time increasing in temperature till the point at which it generally freezes is reached. The heat then manifested, by an increase of temperature was up to that time latent in the water. A very interesting experiment to show that pressure affects the freezing of water was made by filling a cannon ball (shell) with water, closing the opening and exposing it to a low temperature. After a time the pressure produced by the formation of ice was sufficient to break the ball. The pressure being relieved the water froze so quickly that the portion of it which had been forced out had not time to drop to the ground but formed a well defined, sharp ridge of ice.

A factor influencing the freezing of watery solutions is the nature and quantity of the material dissolved. If these be gaseous the water will generally freeze more readily, therefore, water which has boiled requires a lower temperature than that from which some of the gases have not been driven off by boiling. On the other hand solids held in solution lower the freezing point. Since the sap of plants consists of a watery solution of principally solid materials separated by the cell walls into narrow channels or small drops—both factors retarding freezing—we may look in this direction for the explanation of the fact that some herbaceous plants can withstand several degrees of frost without injury.

Remembering that water is only a simple inorganic compound, and reflecting upon its many properties and varied functions, not only in nature but also in the arts, how it is made use of in the steam engine, the hydraulic press, and the water wheel; in the laundry and the kitchen—its effects in the lakes and rivers—how it has excavated monstrous caves and deep ravines— its aid to commerce and its important offices in the soil and the atmosphere, in plants and in our own bodies—and then, when we notice how every property it possesses seems specially designed to make this globe more perfect and to assist in the working of the laws of nature, I am convinced that those who reflect on these things must all feel a desire to study these laws more thoroughly.

EXCURSION TO CASSELMAN.

No. 2.—1892.

The second excursion of the season took place on the 9th inst., and, as advertised in our last issue, the *rendez-vous* was Casselman.

Notwithstanding threatening skies and occasional showers, about twenty-five members and their friends assembled at the Canada Atlantic Railway Station and, nothing daunted, boarded the 2.15 p.m. train. An hour's pleasant ride brought the party to their destination, where by the courtesy of the railway officials a car was side-tracked for the accommodation of the excursionists. As it came on to rain shortly after our arrival, this kindness of the C. A. R. was much appreciated by many of the ladies who determined to make the car their head-quarters.

Despite the shower and braving the mosquitoes, the rest of our party, headed by the energetic Vice-President, Mr. F. T. Shutt, struck down to the river bank. At first the walk along the valley of the winding stream was easy and pleasant and as many a picturesque vista of meandering river and forest-clad banks opened out to view it was very much enjoyed. But soon, alas, the way became more slippery, the underbrush thicker, the mosquitoes more numerous, and some of us, wet and irritated by the myriad attacks of our winged foes, succumbed—gave up further scientific pursuit and returned to the ladies and the car. Those who kept on, however, were well rewarded by the collection of a large number of plants in flower (49) and some magnificent and beautiful ferns—specimens of the *Onoclea Struthiopteris* over six feet in height being obtained.

The exploring party returned from their expedition with keen appetites and enjoyed their tea in the country thoroughly.

The Acting President, Mr. Shutt, spoke for a short time of the beauty of the locality and the pleasures always to be found in attending the Club excursions. Although the party was small, owing to the weather, he felt sure that all had spent a pleasant and instructive afternoon. He suggested that as so few were present it might be better to dispense with addresses upon many of the branches of Natural History. The locality was a rich one in all the different lines of study and on the

present occasion they had with them Mr. J. F. Whiteaves and Mr. F. R. Latchford, both distinguished conchologists. He learned, however, that no species of particular interest had been secured. On a previous occasion Mr, Latchford had found here the only Ottawa specimens of *Helix dentifera*. Most of the collections of the day had been plants, and he therefore invited Mr. Whyte, the Botanical leader, to speak of some of the more interesting species.

Mr. Robert B. Whyte spoke with his usual ease of the many floral treasnres that had been observed or collected by members of the party. About fifty different plants had been found and specimens were shown of the following: Willow-leaved Meadow-sweet (*Spiræa salicifolia*), Twin-berry (*Mitchella repens*), the Loosestrifes (*Lysimachia stricta* and *L. ciliata*), the Moonseed (*Menispermum Canadense*). This last was used as an illustration of the beauty of many of our native climbing plants and their value as ornaments to our dwellings. The Evening Primrose (*Œnothera biennis*) in like manner served to introduce the subject of night-flowering plants. The three wild Raspberries (*Rubus strigosus*, *R. odoratus* and *R. Canadensis*) were used as a text for remarks concerning fruits, and their structure was compared with the Apple, the Plum, and the Strawberry, all of which belong to the same large order the *Rosaceæ*. The Gooseberries, wild and cultivated, were also treated of, as well as some of the ornamental members of the Heath family as *Kalmia angustifolia* and the Round-leaved Winter-green, (*Pyrola rotundifolia*). When speaking of the White Meadow Rue (*Thalictrum Cornuti*) the fertilization of plants received attention, and the seeds of Avens (*Geum strictum*) and the Traveller's Joy (*Clematis Virginiana*) showed the manner in which the distribution of plants was secured. When Mr. Whyte had finished his interesting discourse it was time to return home, and Ottawa was reached at 8.30 p m. Although the weather prevented many from going and those who did venture from enjoying themselves as much as they might otherwise have done, the excursion was by no means an unsuccessful one, and no regrets were heard from the returning party.

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BOOK NOTICES.

MANUAL OF INSTRUCTIONS FOR COLLECTING AND PRESERVING INSECTS, by C. V. Riley, M.A., Ph D., United States Entomologist.

We have just received a copy of the above named work which will be gladly welcomed by a large number of students of nature. There is, perhaps, no enquiry which is more frequently made by amateur naturalists than, "Where can I get the best directions for collecting and preserving insects?"

And there is also, now, since Economic Entomology has become recognized as so important a factor in agricultural pursuits, a constant demand from farmers and gardeners for information as to the best means of collecting for study or for forwarding to specialists for identification any insects which may be found attacking their crops, or concerning which they may wish for enlightenment as to their habits. Prof. Riley has provided in this volume a most complete answer to these demands. Great skill has been shown in selecting from so vast a subject those details only which the author's great knowledge and experience enabled him to judge, were essentials.

This work, which is a pamphlet of 149 pages, excellently well printed and profusely illustrated with figures of the very first order, many of which have been prepared especially for it, is issued by the Smithsonian Institution, as Part F of Bulletin of the United States National Museum, No. 39.

A concise classification of true insects gives in a few pages an excellent summary of the science of Entomology, which is so well illustrated that any tyro will with ease recognize the order to which such specimens as he may find belong.

The different apparatus and means of collecting and killing insects are then dwelt upon at length with special directions for each order.

Under the heading Entomotaxy the preparation, labelling and care of specimens, with the necessary apparatus, cabinets and materials, are treated. Special attention is given to cabinets and their arrangement, and under Museum Pests, Mould, etc., much valuable advice is given which could be gained only by the experience of many years of constant work.

The rearing of insects from the egg is the next snbject. Here we find full instructions for carrying on successfully this fascinating work.

The directions for packing and transmitting insects are short but complete, and it would be well if many that are not merely amateurs would read them carefully and carry them out.

A useful appendix to this manual is a list of text books and other entomological works, with suggestions as to the best way to obtain them.

The publication of this book must, we believe, be followed by a largely increased interest in the study of insect life, as we feel strongly that the chief reason why so few young people, both boys and girls, on this continent have not had their eyes opened to the charms of this branch of Natural History, to say nothing of its usefulness, is the want of such a help as Prof. Riley has now provided in this concise, complete, and plainly written manual.

THE ORTHOCERATIDÆ OF THE TRENTON LIMESTONE OF THE WINNIPEG BASIN, by J. F. Whiteaves, (Trans. Roy. Soc. Can., Vol. IX, Section IV., pp. 77-90, 1892.)

This paper as the author indicates "consists of a critical and systematic list of the *Orthoceratidæ* at present in the Museum of the Geological Survey of Canada from the formation and region indicated it its title, with descriptions of such species as appear to be new." The specimens were obtained, for the most part, by officers of the Geological Survey of Canada: Dr. Bell, Messrs. Tyrrell, Weston, Dowling, Lambe and also by a number of gentlemen interested, e.g., Messrs. Donald Gunn and A. McCharles, the last mentioned having sent unusually fine specimens in 1884.

In this paper Mr. Whiteaves departs from the classification of *Cephalopoda* by Karl Zittel and considers the genera *Actinoceras* and *Sactoceras* as distinct from *Orthoceras*, and *Poterioceras* from *Gomphoceras*. The characters of the specimens examined by Mr. Whiteaves and the grounds upon which that author separates these genera are in our estimation valuable and valid.

The following is a list of the species described and figured (for the most part) in this important paper :

1. Endoceras annulatum, Hall, var.
2. " subannulatum, Whitfield.
3. " crassisiphonatum, N. Sp.
4. Orthoceras Simpsoni, Billings.
5. " semiplanatum, N. Sp.
6. " Selkirkense, N. Sp.
7. " Winnipegense, N. Sp.
8. Actinoceras Richardsoni, Stokes.
9. " Bigsbyi, Bronn.
10. " Allumettense, Billings.
11. Sactoceras Canadense, N. Sp.
12. Gonioceras Lambii, N. Sp.
13. Poterioceras nobile, Whiteaves.
14. " apertum, Whiteaves.
15. " gracile, N. Sp.

It is interesting to note the wide geographical distribution of *Actinoceras Bigsbyi*, Bronn, and of *A. Allumettense*. These two species are well known in the Ottawa region, where there are many Cephalopods of considerable interest which deserve careful study and examination.

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A BOOK FOR BOYS.

We are much pleased to announce that Mr. S. H. Scudder, the well known author of an extensive work on the "Butterflies of the Northern United States and Canada," has now in preparation a Manual for Boys, upon the same subject as his great work. A most noticeable difference between boys and girls in Europe and on this continent is that, in the former nearly every child has some hobby—some pleasant and in most cases improving, but at any rate all-satisfying occupation—to keep it out of mischief. To children Nature offers great charms. There is not a single large school where some of the boys do not study Natural History. The masters, well knowing the value of these pursuits not only on account of their great use in education as preparing the

mind for careful and accurate methods of thought and observation ; but also as inducing healthy exercise and out-door occupation, do everything to encourage scholars to investigate Nature. In Great Britain, in France, in Germany, there are good, cheap, illustrated works upon insects. Many an Entomologist who has afterwards risen to eminence owes his distinction to having had his attention drawn to the study of insects either by a schoolfellow or from having been presented with one of these books. We have absolutely no work upon the many beautiful Butterflies which frequent our Canadian woods, prairies and mountains. Such a volume for Canada and the Northern States as "Coleman's British Butterflies" would be an inestimable boon to many—not only the young, who would be charmed with the many treasures which they would find they had everywhere around them ; but also to fathers and mothers and aunts and uncles who are so often at a loss to find suitable presents for children. Mr. Scudder's name alone is a guarantee that the work will be well done.

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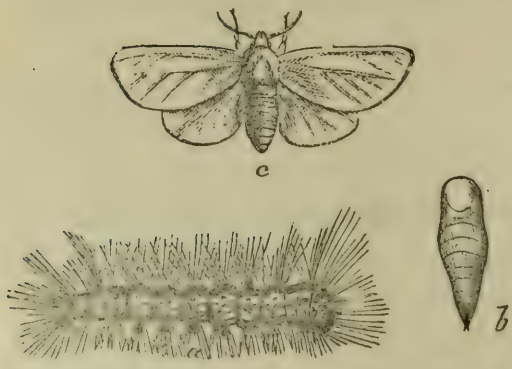
THE FALL WEB-WORM (*Hyphantria cunea.*)

By J. Fletcher.



In the above figure are shown the caterpillar, chrysalis and perfect insect of the Fall Web-Worm, one of the greatest pests to our shade and fruit trees. The moth, which in the northern form, as it occurs at Ottawa, is pure white with gray antennæ or feelers; its front thighs are yellow and the feet dark. Further to the south the moths are frequently ornamented with many black spots, but I have never seen this form in Canada. At the present time, many of our shade trees are rendered unsightly by the nests of the social caterpillars of this insect and this note is inserted to request the members of the O. F. N. C. to set a good example by destroying them whenever they

observe the nests, and requesting others to do the same on every opportunity. As yet the webs are not very large, but they will be rapidly increased in size by the caterpillars as they grow to maturity, and unless removed will remain through the winter as a disfigurement to the trees and a disgrace to the community.

The eggs are laid upon the leaves of a great many difierent kinds of shrubs and trees in July, in clusters which are composed of a large number of greenish white eggs and are more or less hidden by a loose covering formed by the female of her own scales. The eggs soon hatch and the young caterpillars at once begin to spin a protecting web. They are pale yellow at first, with black heads and two rows of black spots along the body, and are covered with slender hairs. When small they eat only the upper surface of the leaves, skeletonizing them. They grow rapidly and enlarge the web as they develop. They remain almost entirely in their tent and will destroy the foliage of a large-sized branch in a short time. When full-grown they are about an inch in length and vary greatly in their markings. Some specimens are pale yellowish, whilst others are of a deep gray. The head is black and there is a broad dark stripe down the back. Along each side is a yellow spotted stripe. The body is covered with long soft hairs which vary in colour, and whice arise from a number of small black or orange tubercles. When almost full-grown they give up their social habits and scatter in all directions to continue their depredations. They pass the winter in the chrysalis state within slight cocoons which they spin either amongst fallen leaves, in crevices of bark, or a short distance beneath the surface of the soil, where they remain until the following summer.

The webs from the very first are conspicuous objects and from the social habits of the caterpillars a whole colony is easily destroyed by cutting off the nest and trampling it under foot. To take this small trouble in order to protect our shade trees from one of their worst enemies is what I am asking our members to do.

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A. A. A. S.

The next Annual Meeting of the American Association for the Advancement of Science and the Associated Societies, will be held this year at Rochester, N.Y., beginning on August 15th and ending about August 24th. The proximity of Rochester should induce many of our members to take this opportunity of meeting the numerous men of note who always attend the A. A. A. S. meetings.

EXCURSION III.

TO LA PÊCHE ON THE GATINEAU.

The Third Excursion of the Club will most probably be held on Saturday, September 3rd, to LA PÊCHE, on the Gatineau Valley Railway. The great success of the first excursion up the Gatineau, added to the fact that a large number of members who have asked for another expedition by the Gatineau Valley Road, have induced the Council to arrange for another outing as soon as possible. Definite arrangements cannot yet be made as to the prices of the tickets. These will probably be about 50 cents for adults. The larger the number that attend, the smaller will be the price. There is no desire to make any profit on the Club excursions, all that is wanted is to cover the necessary expenses. An effort is always made to get as large an attendance as possible so as to popularise the Club and its objects, which are to bring together for a pleasant day in the country those interested in the various branches of Natural History, and to take every opportunity of inducing more to study the things of beauty which surround them on every side. Arrangements are always made to give members of the Club an advantage in the prices of the tickets; but the excursions are open to all without exception. The Council trusts that every member will help to make this excursion a succes and endeavour to attend and induce others to do so also. Definite notice of the prices of the tickets and of the times of the trains will be given in the September OTTAWA NATURALIST, which our readers are respectfully requested to consult. Every notice of an excursion which is made by circular costs, for printing and postage, about $4 which has to be made up by charging a higher rate for the tickets. If, therefore, members will look for NOTICES on the top outside cover of the monthly magazine they will see at a glance if there is to be an excursion, and inside on the last page will be found the full particulars. In this way the expense of the circulars will be obviated and the price of the tickets will be reduced.

ADDITIONAL NOTES ON THE GEOLOGY AND PALÆONTOLOGY OF OTTAWA AND ITS ENVIRONS.

By Henry M. Ami, M.A., D.Sc., F.G.S., &c., &c.

Introduction.

The following notes comprise a brief sketch or résumé of work done by the writer during the season of 1890 in connection with the Ottawa Field Naturalists' Club.

From my note book I find that no less than nineteen excursions and sub-excursions were held in various directions around Ottawa. Old Chelsea, Lachute, Casselman, Rockliffe, Moose Creek, Hull, Gloucester and several localities within the city limits, were visited and numerous forms of interest were gathered The variety and quantity of material still to be discovered and described which the various geological terranes about Ottawa can afford are sufficient to satisfy as well as entice the student of Geology for years to come.

Notes.

Old Chelsea.—On the 31st of May, Butternut Grove, Chelsea, was visited by about 125 members of the Club. The geological party, amongst whom were Prof. L. W. Bailey, of the University of New Brunswick, and Mr. H. T. Martin, of Montreal, visited the magnificent outcrops of crystalline limestone at the ravine, near Old Chelsea, and brought back an interesting suite of specimens illustrating the character of the belt of Archæan rocks in that district. Specimens of apatite, asbestus, serpentine, pyroxene, wollastonite, gneiss, diabase, and numerous other rocks were obtained and described by some of the leaders on the spot.

Lachute.—On the 7th of June, a joint excursion of the Natural History Society of Montreal and of the O. F. N. C. was held in the picturesquely situated town of Lachute, Que., where the geological section was put in charge of Mr. McOuat, B.A., and the writer. The Laurentian and Calciferous horizons were visited and a number of the characteristic fossils from the latter terrane were oberved in the collections, which, as judge in the awarding of prizes, I had an opportunity of examining. *Ophileta compacta*, Salter, (*O. complanata*, Vanuxem), *Pleurotomaria Canadensis*, Billings, *Murchisonia Anna*, Billings, and fragments of other forms were noted.

Mr. Whiteaves, of our Club, gave a graphic description of the geological structure of Lachute and its vicinity, whilst the writer was called upon to read the results of the competition in geology.

Casselman.—On the 21st of June over 100 members and friends of the Club visited Casselman, a favourite locality for all branches of our Club's work, along the line of the Canada Atlantic Railway, and a considerable amount of work was done in the *Trenton* and *Quarternary* deposits there exhibited. Quite a list of Trenton fossils was obtained and specimens of pottery and an arrow-head together with bones of the beaver and other creatures were found close to where on previous occasions numerous collections of Indian relics had been made. The old aboriginal fire-place, in which debris of pottery, bones, charcoal, and Indian remains were found, had been washed away by the high water and spring floods. This locality is a most interesting one, and careful research may reveal unexpected treasures in Ethnological studies.

Hog's Back, Rockliffe, &c.—The Chazy terrane which offers such an interesting field for research about Ottawa, was visited, at Hog's Back, in Nepean, and at Rockliffe, below Governor-General's Bay. Interesting rocks and trails of marine animals, some of which are perfectly new to science, and others resemble the *Protichnites* of Sir Richard Owen described in the Quarterly Journal of the Geological Society, London, from the Potsdam of Canada, were obtained and preliminary studies of them have been made.

The Trenton rocks of Governor General's Bay, Moose Creek, and the Beaver Meadow were also visited at sub-excursions and notes taken at each of these localities as to the character of the rocks, dip of the strata and fossil remains contained therein.

Gloucester.—The Utica terrane in the vicinity of the Rideau River rapids opposite the Rifle Range in Gloucester was again visited. I was fortunate enough in finding two more examples of the *Turrilepas Canadensis*, recently described by Dr. Woodward in the Geological Magazine, and it is expected that these additional representatives of that antique style of barnacle will through some light on the type specimen found at the same locality in 1888.

The Tethæoid sponge from the Utica which I had found in the excavations on Albert street in 1888 and in rocks of the same horizon

on the Montreal Road about 200 yards east of the St. L & O. Ry. crossing and noted in the last Report of the Geological Branch, has beensince referred to Dr. George Jennings Hinde of Croydon, Eng., the best authority on fossil sponges, and he has described it in the "Geological Magazine" for January 1891, pp. 22 to 24. under the name of *Stephanella sancta*, (N. gen. et n. sp.)

This species along with *Brachiospongia digitata*, Owen, *Astylospongia parvula*, Billings, *Steliella Billingsi*, Hinde, *Steiella crassa*, Hinde, and *Hyalostelia* sp. from the Trenton of Ottawa, comprise most of the ancient sponge fauna occurring in the Ordovician Seas known from this region.

Moose Creek.—The Pleistocene deposits of Moose Creek, Green's Creek, Experimental Farm and Casselman were examined in several cases in detail and interesting notes obtained ;—

At Moose Creek the following species were obtained in the stratified gravels north of the C. A. R. track : —

1. Tamias striatus, Linn.
2. Mytilus edulis, Linn.
3. Macoma fragilis, Fabricius,
4. Macoma calcarea, Chemnitz.
5. Saxicava rugosa Linn.
6, Balanus crenatus, Bruguiere.

Mr. Walter S. Odell, one of the recent and valuable additions to the membership of our Club, brought to my notice several specimens of fossils from the '*Leda*' clays of Odell's brick yard, just S.E. of Ottawa city, and amongst the forms examined there were bones of the seal, and fine specimens of a fossil sponge, besides foraminifera.

List of Fossils from the Clays of Odell's Brickyard

1. Phoca Groenlandica, Mueller.
2. Tethæa Logani, Dawson.
3. Saxicava rugosa, Linnæus.
4. Polystunella crispa.
5. Dentalina sp.
6. Eschara elegantula, d'Orbigny.

Besides the above notes on specimens and excursions, as well as

localities visited, Montebello and Kirk's Ferry, on the North shore of the Ottawa, were visited, and interesting collections and notes taken at both places.

Montebello.—At Montebello on the 19th July, and through the kindness of Mr. L. J. Papineau, who placed his yacht and services at the disposal of the Geological Branch, an interesting exposure of the Potsdam terrane, showing rippled-marks in abundance, besides the tracks and trails of marine animals (*Protichnites septemnotatus*, Owen), was visited on the Presqu'ile north of Squirrel Island. This exposure of the Potsdam presents a bold bluff of from ten to twenty-five feet front in height, above low-water mark at this time of the year, facing the north or Laurentide Hills, clearly indicating the existence of an open and free channel from east to west in Pre-glacial times. The sandstones were beautifully glaciated in several places, and showed that the march of the old glaciers was at right angles to the present flow of the Ottawa, and in a north and south direction, down from the adjoining slope to the north.

Kirk's Ferry.—At Kirk's Ferry, up the Gatineau River eleven miles, a most successful excursion was held, and the magnificent rock cuts along the Gatineau Valley Railway afforded excellent opportunity of examining the relations of Archæan rocks of various kinds, in close contact and at times fused one into the other. Crystalline limestones, graphite, ophite, calcite, diorites and pyroxenites, as well as apatite and mica, were collected. This region and cutting is well worthy of close attention on the part of the petrographical geologist.

Radiolarians.

In May, 1890, I prepared a number of specimens of rock from the Shales of the Utica, in Gloucester, from the limestones of the Trenton, Ottawa, and also from the calcareo-arenaceous shales of the Chazy of Nepean, for Mr. Tyrrell, who was sending away to Dr. Rust, in Germany, specimens of radiolarian rocks from Manitoba and the North-West. Mr. Tyrrell has since heard that the Ottawa specimens have been examined, but no radiolarians were found therein.

Although this note is negative, still it shows that probably these low organisms in the economy of nature were absent in the Ordovician seas of the Ottawa Palæozoic Basin.

Crinoids.

Mr. John Stewart, of our Club, whose collections of crinoids and blastoids from the Trenton of Ottawa have recently been purchased by the Geological Survey Department and placed on exhibition in the Museum, informs me that he has cleaned and prepared *twenty-five* more specimens to show the cup, arms and pinnules. The great care, industry and skill which Mr. Stewart has displayed in developing these "stars" and "lilies" of the old abyssal depths in our district are worthy of much commendation and eulogy.

Ostracoda.

Amongst the new forms of ostracoda recently described by Prof. Rupert Jones, F.R.S., we find the following species from Aylmer and Ottawa. These forms were collected by Messrs. W. R. Billings, T. W E. Sowter and the writer, of our Club.

1. Primitia Logani, Jones, Aylmer, Que.
2. Beyrichia clavigera, Jones, " Que.
3. " var. clavifracta, Jones, " Que.
4. Isochilina Ottawa, Jones, var. intermedia, Jones, Ottawa; Ont.
5. " labellosa, Jones, Aylmer, Que.
6. Leperditia Balthica (Hisinger), var. primæva, Jones, Carleton Co.
7. " sp. (cf. L. Hisingeri), Aylmer, Que.

Of the above, only Primitia Logani, Jones, is referred to the Trenton terrane, the others and this form are all Chazy species.

In the "Journal of the Cincinnati Society of Natural History," Prof. E. O. Ulrich, well known to several members of our Club, has described the new species of Ostracod from Ottawa and also a variety of the same species from the same block of impure limestone. The specimen sent contained abundance of individuals of an Isochilina, besides a Cyrtodonta or allied genus of lamellibranchiate mollusks—all from the Chazy.

Prof. Ulrich, on pp. 44 and 45 of his paper on "*New and Little Known American Paleozoic Ostracoda*," and on Plate XI., figs. 12a, 12b, 12c and 13, has described the following forms and named them after one of our Club:—

1. Isochilina Amiana, Ulrich.
2. Isochilina Amiana, var. insignis, Ulrich.

Both forms occur together and were collected on Sussex Street, Ottawa, from a block of erratic limestone of Chazy age, showing marks of glacial action, having come from the "till," or "boulder clay" of the vicinity.

It is the purpose of the writer to present to the Club through the pages of the NATURALIST a suite of articles on some of the best fossiliferous localities in Ottawa and Hull for the use of collectors and students in Geology.

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BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, EDINBURGH, SCOTLAND.

The 61st meeting of the British Association for the Advancement of Science was held, in Edinburgh, Scotland, under the presidency of Sir Archibald Geikie, F. R. S. etc. Director of the Geological Survey of the United Kingdom, Aug. 3rd, 1892.

This year is the *one hundredth* anniversary of the publication of Hutton's "Theory of the Earth" which is admitted to be the first plausible and rational view presented of the upbuilding and construction of the Earth's crust. It sought to account for such diversity of phenomena, formations and strata as were visible on the Earth's surface at the present day, in the changes which are now taking place. By applying this rule *in retrospectu* Hutton was able to account for the different formations now visible.

Sir. Archibald then went on to describe the various points of indebtedness which modern geologists still owe to Hutton and the Huttonian School; the "high antiquity of the Earth," the explanation of olden time phenomena by present ones, the progression in organic types, &c., &c., which with views held by Sir James Hall, William Smith, Kelvin, Playfair and others, placed the main results and leading objects in view on a scientific and practical basis.

Many opposing forces had to be met. Preconceived notions, theories and so-called orthodox views of learned men of the days of Hutton, all assailed the new theory. But it was founded on facts and

hard facts which told a tale of paramount importance and exciting interest, revealing in each formation of the Earth's crust pages of unwritten history: it was the Earth telling its own tale.

Sir Archibald Geikie then pointed out the salient conclusions which had been already arrived at, with reference to the boundless antiquity of the globe, presented Lord Kelvin's views as to the limit of time that may be assigned to our planet's antiquity. "He estimated that the surface of the globe could not have consolidated less than 20 millions of years ago, for the rate of increase of temperature inwards would in that case have been higher than it actually is; nor more than 400 millions of years ago, for then there would have been no sensible increase at all." "One hundred millions of years" was regarded by him as the probable amount of time which embraces the Geological history of the globe."

These calculations, Sir Archibald holds, "may require revision," and states "that there must be some flaw in the physical argument." From his own observations on "degredation" or "denudation," the erosion of rocks and deposition of sediments, he has reached the conclusion that "the rate of deposition of new sedimentary formations over an equivalent area of sea-floor, may vary from one foot in 720 years to one foot in 6,800 years."

Then the "slow progress of organic variation" is discussed, giving its quota of evidence in support of the antiquity of the world. Precise data are wanting in this particular. "We know, says the distinguished geologist, "that within human experience a few species have become extinct, but there is no conclusive proof that a single new species has come into existence. nor are appreciable variations readily apparent in forms that live in a wild state." He then instances the seeds and plants found with Egyptian mummies being precisely the same as those of modern Egypt. This negative evidence, of no change, is an important factor in the problem, and indicates the lapse of an enormous interval of time sufficient to modify forms of shells, etc.

With reference to this problem and the Ice Age on which Sir Archibald Geikie has so ably and oftimes written, he says: "If the many thousands of years which have elapsed since the Ice Age have pro-

duced no appreciable modification of surviving plants and animals, who vast a period must have been required for that marvellous scheme of organic development which is chronicled in the rocks? After careful reflection on the subject I affirm that the geological record furnishes a mass of evidence which no arguments drawn from other departments of nature can explain away, and which, it seems to me, cannot be satisfactorily interpreted save with an allowance of time much beyond the narrow limits which recent physical speculation would concede." In conclusion the President referred to the geological features of Edinburgh, which had furnished so much material for enjoyment during his life.

H. M. A.

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BOOK NOTICE.

THE CULTIVATED NATIVE PLUMS AND CHERRIES (BULLETIN 38. CORNELL UNIVERSITY EXPT. STATION, JUNE 1892.) BY L. H. BAILEY.

In this monograph of 73 pages Prof. Bailey has embodied a large amount of practical information as well as accomplished the very difficult task of making a thorough classification of our native Plums and Cherries.

With plums the work has been particularly complicated, and only the most patient study and research could have been rewarded by such gratifying results.

Up to the present time our cultivated native varieties have been roughly assigned to three wild types. (1) *Prunus Americana*, Marshall the plum of the north and west (2) *Prunus angustifolia*, Marshall, or *P. chickasa*, Michx, native of the middle and Southern States and (3) *Prunus maritima*, Wangheim, known as the Beach plum of the south. Much confusion existed however as many of the cultivated forms could not be satisfactorily assigned to any of these original types. Prof. Bailey says, "There has been no attempt so far as I know, to make a comprehensive study of these fruits and as a consequence our knowledge of them is vague and confused. In fact, the native plums constitute probably the hardest knot in American pomology. Their botanical status is equally unsatisfactory aud the group is one of the most inextricably confused of any of equal extent in our whole flora." As a result of

the author's labours we shall recognize hereafter another class, known heretofore as the Wild Goose group, under the name of *Prunus hortulana* and falling under this as a variety the Miner, a plum of considerable value to us in the north. This group is assigned an intermediate position between *P. Americana* and *P. chickasa*. To these three groups belong practically all our cultivated native varieties in Canada. The origin of the *marianna* and *myrobolan* varieties, which are now so generally used as stocks for budding and grafting, is ably discussed. By most authors these are supposed to be of American origin, Prof. Bailey however traces them to Europe and points to a common parentage.

The Beach plum has as yet given us no cultivated varieties of any value. In this work we have the only authentic account of "an undoubted hybrid" between Troth's Early peach and the Wild Goose plum. "The leaves are long and peach like, although rather broad and short-pointed but the flower buds, although they form in profusion, never open, so the tree is barren".

The Bulletin also discusses, stocks for the propagation of and the fungous diseases of the plum. Concluding the author fitly remarks that the native plum industry has made astonishing progress and it has already assumed large proportions. It is certain to occupy a large place in future American horticulture." In discussing the native cultivated cherries the author is of the opinion that two or possibly three species are being grown under the name of *Prunus pumila* the sand cherry of the north and west. This is the only wild form which has gained much prominence under cultivation. In the north western States it is now being grown to a considerable extent, and under cultivation is said to be very susceptible to improvement. Other native species are discussed though their fruit does not appear at present to be of economic value.

Such Bulletins elevate the character of Experiment station research in horticultural lines, are of exceeding interest to the intelligent fruit grower and are fundamentals to a sound basis for the building of a correct nomenclature of our American Pomology.

JOHN CRAIG,
Horticulturist, Central Experimental Farm.

THE GEOLOGICAL SOCIETY OF AMERICA.

The Fourth Annual and Summer Meeting of the Geological Society of America was held last week in Rochester, N. Y., and in connection with the Forty first Meeting of the American Association for the Advancement of Science.

There were upwards of fifty fellows present. Monday and Tuesday, August 15th and 16th, were the days set apart for the reading and discussion of papers. The warmest and most animated discussion took place on the second day—when two papers on the "Ice Age," by Messrs. Warren Upham and G. Frederick Wright, well known glacialists, were taken up. Mr. Upham's paper was a detailed description of the origin, mode of formation and "conditions of accumulation of Drumlins," illustrated with numerous diagrams and figures of various forms met with in different districts. Drumlins were made up of *en-glacial* drift material accumulated rapidly and during the departure of the ice close to the border. The author referred to the irregularity of the drumlins as puzzling. The relation of drumlins to the terminal moraine was also discussed, as also the different shapes drumlins assume owing to the conditions under which they are accumulated.

Prof. G. F. Wright's paper then followed on the subject: "The extra-morainic drift of the Susquehanna Valley." This so-called "fringe" of the long, great terminal moraine was of much importance and significance. Its remote antiquity was discussed. A detailed account of careful observations made by the author in the Valley of the Susquehanna was then given. In the discussion which followed both papers Messrs. Gilbert, McGee, Salisbury, Upham, and Wright took part.

Prof. C. H. Hitchcock's "Studies of the Connecticut Valley Glacier," also proved of considerable interest.

Prof. James Hall, the veteran palæontologist of North America, who was the first to welcome us on arriving at Rochester, received a very hearty reception on presenting his paper "On the Oneonta Sandstone; its relations to the Portage, Cheming and Catskill Groups." This was a remarkable paper in which the correlation of strata by lithological or petrographical characters as well as of faunas by palæontological characters was rendered difficult by the variety and number of formations

and faunas in the State of New York, characterizing the close of the Devonian epoch. The equivalencies in time and true relations of the faunas were clearly delineated, and much satisfaction with new light resulted from the observations made by Prof. Hall. Messrs. I. C. White, E. W. Claypole, J. J. Stevenson, and others took part in the discussion.

"On the dentition of Titanichthys and its allies," was the subject of an interesting paper by Prof. E. W. Claypole, giving the result of his observations on the jaws of the gigantic fish which existed in Devonian times. An important matter relating to Devonian fishes came up at this meeting of the Geological Society, regarding the mode of occurrence or origin and habitat of the Devonian fishes. Were they *freshwater* or *marine* fishes? Were they lacustrine or sea fishes. Prof. J. J. Stevenson argued for their marine character, and Prof. Claypole for their fresh-water nature. A revision of the evidence on this point is necessary before a conclusion can be arrived at.

Other papers read were as follows :—

Lawrence C. Johnson.—Notes on the Phosphate Fields of Eastern Marion and Alachua Counties, Florida.

G. F. Becker.—Finite homogeneous strain, flow and rupture of rocks.

Wm. H. Hobbs.—Phases in the metamorphism of the schists of Southern Berkshire.

Charles L. Whittle,—Some dynamic and metasomatic phenomena in a metamorphic conglomerate in tne Green Mountains.

G. C. Broadhead.—The Ozarks and the geological history of the Missouri Palaeozoic—10 minutes.

David White.—A new Tæniopterid fern and its allies—10 minutes.

A. S. Tiffany.—The overturn of the Lower Silurian Strata in Rensselaer Couuty, N.Y.—5 minutes.

Ancient Waterfalls.—7 minutes.

Of these last seven some were read by title others *in extenso* and others were briefly sketched out. Mr. David White's paper on a new Taeniopterid fern was a pleasing contribution to Palæobotany and showed those present how exceedingly careful a palaeobotanist has to be in separating portions of the same plant, parts of which at times resemble

one constituted genus and at other times an altogether different one.

Notes.

At a meeting of the Council of the Geological Society of America held on Wednesday, Aug. the 27th, it was decided to accept the invitation to visit Ottawa at the coming meeting to be held in December.

The Royal Society of Canada and the Logan Club of Ottawa made up of the scientific staff of the Geological Survey Department, had both sent an invitation to the Geological Society.

Accordingly, the Ottawa brethren of the hammer may expect a large attendance of geologists from all parts of the North American Continent in December. The Geological Society of America numbers some 250 Geologists, all of whom are actively engaged in Geological work.

Ottawa is especially favoured as a centre of geologic interest, both on account of the Geological Survey Department having its headquarters here and the Museum of economic minerals and palæontology being located at the Capital.

H. M. A.

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ENTOMOLOGY.

Edited by W. Hague Harrington.

Among the more conspicuous plants of the August landscape may be indicated Golden-rods, Mulleins, Thistles and Milk-weeds, each of which nourishes insects peculiar to itself.

The various species of *Solidago* make gay the fields and woodsides with myriads of golden plumes to which resort many insects of various orders, and especially of Hymenoptera, Here the honey bee may be found industriously working, in company with many wild relatives, as Bombus, Megachile, Andrena, Apathus. etc., while numerous kinds of fossorial wasps, etc., are generally abundant.

Occasionally on the leaves may be observed a small gourd-shaped black case, attached firmly by its neck. This is constructed by the larva of a small chrysomelid beetle, *Exema gibber*, which may be captured by beating or sweeping the flowers, but its little black wrinkled form is liable to be overlooked in the net, from its resemblance to the

excrement of caterpillars. It is placed on the Ottawa list for the first time this year, several specimens having been obtained near Dow's Swamp, on Saturday, 26th August.

Phymata Wolffi, a peculiarly shaped bug, with robust raptorial fore-legs, often lies in wait among the flowers for bees and other insects. It was quite abundant at Casselman on one occasion (8th Aug.) when the Club visited that point, but none have been observed about Ottawa this season.

The Mullein is able to nourish its broad flannel leaves and tall spikes of yellow flowers in thin and stony fields, where even the thistle is starved out. It is not much attacked or frequented by insects, but a small stout weevil, or snout-beetle, *Gymnetron teter*, infests the seed-vessels. The larvæ and pupæ may generally be obtained from the nutlets, and they were especially abundant this year in mulleins growing along the gravelly beach at Aylmer. On some spikes there was hardly an uninfested nutlet.

Probably fifty per cent. of the seeds of the common Canada thistle are devoured by the maggots of a two-winged fly, *Trypeta florescentiæ*, whose presence may be detected by the irregular appearance of the down, or pappus, on plucking which it comes away without the seed and is found all matted together at the base and containing one or more yellowish maggots or pupæ, which are those of the beneficial fly.

A parasite of the fly is also very common and destroys a large proportion of the maggots. It belongs to the genus *Solenotus* of the Chalcididæ, and has been named by Hr. Ashmead *S. Fletcheri*, but its description has not yet been published.

From the infested heads are also bred numbers of another small chalcid, very similar in appearance to the Solenotus. Mr. Ashmead, who has described it in the Canadian Entomologist, considers it to be a secondary parasite.

Upon the Milkweeds at this season a very handsome greenish-black beetle with orange markings is not uncommon. It is of the same size as the Colorado potato-beetle, to which it is closely allied, and has received the name of *Doryphora clivicollis*.

A handsome black and scarlet bug, *Lygæus Kalmii*, is also abundant, but the strong odour which it emits, in common with many hemiptera, makes its capture and investigation somewhat unpleasant.

Earlier in the season there might be found upon these plants two other insects peculiar to Asclepias, viz., a longicorn beetle, *Tetraopes tetraophthalmus*, red with black spots, the larvæ of which feed in the roots or lower stems, and the larva of the big Milkweed butterfly, *Danais archippus*, a conspicuous caterpillar strikingly ornamented with narrow yellow, white and black bands.

Members sometimes enquire as to the time for collecting caterpillars, so it may be noted that just at this season the larvæ of many of our larger moths attain maturity, and thus very interesting species can be easily secured.

Among caterpillars which have been unusually abundant this summer may be mentioned that of *Leucarctia acrea*, the so-called Salt-marsh caterpillar, which, however, is not confined to the sea-coast, but has been more or less destructive all over the country.

This is also a good season to examine for galls the oaks, hickories, willows, golden-rods, Lactuca, Nabalus, sumac, asters, etc., etc.

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ORNITHOLOGY.

Edited by A. G. Kingston.

Robins as Destroyers of Hairy Caterpillars and White Grubs.

One of the large Wooly-bear Caterpillars (*Leucarctia acræa*) has been unusually abundant at Ottawa this year, Mr. Fletcher reports having seen Robins on several occasions eating these caterpillars. They are not eaten at once; but are shaken and rubbed in the grass and on the ground for a minute or two when most of the long hairs are found to be removed. By running out suddenly the birds were on two or three occasions driven off and their victims examined. The same birds were also noticed doing good work on lawns by destroying the larvæ of the May-beetles the injurious White Grubs.

The Chimney Swift

Our local colony of these singular birds, swollen by the large number of young hatched during the present season, appears to have its quarters at the Western Departmental Buildings too crowded for comfort. On the evening of 27th August a considerable flock was observed circling in their usual manner above the City Hall and finally descending into a small ventilating tower on the north side of that building. These

birds have generally shown themselves intensely gregarious, and it is quite unusual for them to over-flow in this manner.

Swallows.

The recent autumn-like weather with clear or cool nights and heavy dew has so shortened the supply of insect-life that most of the birds which take their food upon the wing are now showing evident signs of speedy departure. In various parts of the city large assemblies of Purple Martins have been observed wheeling for hours over some favourite district. Occasionally they may rest for a while perched in long ranks upon the Telephone wires, but each member when addressing the house rises to the wing and from the solemnity and yet earnestness of the whole proceeding it is clear that business of importance is being discussed.

When we recollect that 60 or 70 days hence must find them in Central or even South America, that this journey is to be made through all the tempestuous weather of autumn, and with a failing food-supply, and that more than one half of the company, the young of the year, are entirely without experience of long flights, it will be seen how great responsibility rests upon the leaders in these great migrations.

The last week of August generally sees the departure of these and all the other species of swallows except the White-belly (Tachycineta bicolor.) The latter the hardiest of all the family arrives a week earlier, stays at least as much later, and makes its winter home no further south than Louisiana and Mississippi.

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BOTANY.

The following Rules for Botanical Nomenclature were drawn up at the recent meeting of the A. A. A. S. at Rochester, and will, we feel sure, be read with interest by our Botanists.

THE NEW RULES FOR BOTANICAL NOMENCLATURE.

The Botanical Club of the American Association for the Advancement of Science at a meeting held Aug. 19th. 1892, adopted these principles of Nomenclature: *Resolved:* That the Paris code of 1867 be adopted except where it conflicts with the following:

1. The Law of Priority.—Priority of publication is to be regarded as the fundamental principle of botanical nomenclature.

2. Beginning of Botanical Nomenclature.—The botanical Nomenclature of both genera and species is to begin with the publication of the first edition of Linnæus's "Species Plantarum," in 1753.

3. Stability of Specific Names.—In the transrer of a species to a genus other than the one under which it was first published the original specific name is to be retained, unless it is identical with the generic name or with a specific name previously used in that genus.

4. Homonyms.—The publication of a generic name or a binomial invalidates the use of the same name for any subsequently published genus or species respectively.

5. Publication of Genera.—Publication of a genus consists only (1) in the distribution of a printed description of the genus named. (2) in the publication of the name of the genus and the citation of one or more previously published species as examples or types of the genus, with or without a diagnosis.

6. Publication of Species.—Publication of a species consists only (1) in the distribution of a printed description of the species named, (2) in the publishing of a binomial, with reference to a previously published species as a type.

7. Similar Generic Names.—Similar generic names are not to be rejected on account of slight differences, except in the spelling of the same word; for example *Apios* and *Apium* are to be retained, but of *Epidendrum* and *Epidendron*, *Asterocarpus* and *Astrocarpus*, the later is to be rejected.

8. Citation of Authorities.—In the case of a species which has been transferred from one genus to another the original author must always be cited in parenthesis, followed by the author of the new binomial.

John M. Coulter,
William A. Kellerman,
Lucien M. Underwood,
Lester F. Ward,
N. L. Britton,
Henry H. Rusby,
Frederick V. Coville,
Committee.

EXCURSION No. III. TO LA PÊCHE.

As noticed in the last number of the Naturalist the next Excursion has been arranged to take place on Saturday, the 3rd September. The party will leave the C. P. R. Union Station at 10 a.m. by the Gatineau Valley Railway, and will reach the city again by 7 o'clock in the evening.

Tickets, Members	50 cents.
" Non-Members	60 "
Children of Members	25 "
" Non-Members	30 "

Tickets can be obtained at the Station.

NOTES ON SIX LECTURES

DELIVERED BY ROBERT WARINGTON, F. R. S., ON THE

AGRICULTURAL INVESTIGATIONS AT ROTHAMSTED, ENGLAND.

PUBLISHED BY THE U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, 1892.

By Frank T. Shutt, M.A., F.I.C., F.C.S.

In the early years of the present century Sir John Bennet Lawes, associated with Dr. Gilbert, began those experiments, the results of which have been so potent in revolutionizing agriculture throughout the civilized world. Thoroughly practical and at the same time thoroughly scientific, these investigations and the deductions made therefrom have served not only to materially improve the system of agriculture by increased production at decreased cost, but also to elevate farming from an art overgrown with traditions, handed down from father to son through successive generations, to the ranks of science. Agriculture has now taken its place in our universities side by side with Classics, Mathematics and Natural Sciences. It fills that place worthily; and that this is so is largely due to the skilful and indefatigable labours of those English scientists, Sir John Lawes and Dr. Gilbert.

During the summer of 1888, the writer had great pleasure in visiting Sir John Lawes's estate at Harpenden in Hertfordshire, Dr. Gilbert very kindly acting as escort and explaining the many experiments then in progress. The grand old manor of Rothamsted, which has been in the Lawes family since 1623, was built in the fifteenth century, or as Mr. Warington remarks, before Columbus discovered America. Assisted by a young chemist of the name of Dobson, Sir (then Mr.) John Lawes began experimenting in 1837 on the effect of soluble phosphate. Although these trials were only carried on in pots, the results were so gratifying that Mr. Lawes took out a patent for manufacturing superphosphate from mineral phosphate and sulphuric acid. This marks the beginning of the manufacture of this fertilizer, an industry now grown to such gigantic proportions and of such great benefit to agriculture. In 1843 he was joined by Dr. Gilbert, a former pupil of Liebig, as chemist. For over half a century these two (Sir John himself being

a chemist of no mean repute) have worked together in agricultural investigation until now their names are inseparably linked in the history of modern agriculture.

With the exception of the Experiment Station founded by the eminent chemist Boussingault in Alsace, Rothamsted was the first place at which systematic experiments in agriculture were tried. Germany followed in the good work by the establishment of a Station at Möckern in 1852. It was there that the writer saw a few years ago Respiration Experiments in progress, involving the use of costly and elaborate apparatus and a great expenditure of skilled labour of the highest order. And it may be here remarked that the results of these investigations have done much towards putting the feeding of animals on an economic and scientific basis. On this continent the first agricultural experiment station was founded in Connecticut in 1875. Sir John Lawes could therefore very properly claim priority for Rothamsted in this noble and important work, and it is here but meagre justice to state that from this early date these investigations have been conducted at his sole expense.

With the large staff of chemists constantly engaged, it is easy to imagine the vast amount of data that from time to time has accumulated at Rothamsted. The published accounts of these are to be found in the transactions of the Royal Society (England,) of the Royal Agricultural, the Chemical and other scientific societies as well as in pamphlet form and in journals devoted to agriculture. If they were now collated they would fill many large volumes. Recognizing the tremendous importance of the work and wishful that it should continue after his lifetime, Sir J. B. Lawes in 1889 endowed the institution and entrusted its management to a board of trustees. With great generosity he made over to them the new chemical laboratories recently built, the experimental fields and £100,000 as an endowment fund. In this deed of trust, known as the Lawes Agricultural Trust, Sir John made provision for a course of lectures on the Rothamsted Experiments to be delivered biennially in the United States so "that Americans may share in any benefit that may arise" from the work there, past, present and future.

Mr. Robert Warington, F.R.S., so long an associate with Dr. Gilbert

in the chemical investigations at Rothamsted, was chosen to deliver the first course of lectures before the Association of American Agricultural Colleges and Experiment Stations at Washington in August of last year. The choice was a wise one. Mr. Warington being connected with Rothamsted more or less closely since 1859 was thoroughly conversant with the many lines of experiments carried on and the results obtained there. His own work there has been of a varied character. The analyses of the ash of plants and animals, the chemical examination of soils, rain. drainage and well-waters, a lengthy investigation into the process of nitrification in soils and the chemical action of certain soils and bacteria form a few of the most important subjects upon which Mr. Warington has been engaged.

It would be impossible with the space at our command to give an adequate account of all Mr. Warington said at Washington. The lectures have recently been issued by the U. S. Department of Agriculture and form an octavo pamphlet of over 100 pages. They are well worthy of careful perusal by those interested in modern and progressive agriculture; it must suffice us here to do little more than indicate the subjects there expanded.

Lecture 1. Contains an historical account of the Rothamsted institution and enumerates many of the experiments conducted with animals and in the field. In this connection we must quote one experiment, as the result is both interesting and important. It proves that wheat as we know it is the outcome of artificial development and emphatically teaches the choking power of weeds. In 1882 a plot of wheat was not harvested, *i. e.* the grain was left to fall when ripe upon the ground and sow itself. "The first self-sown crop (1883) came up strong, but was so starved by the weeds that the produce of grain probably did not exceed a few pints per acre". Self-seeding was again allowed, but the end was near. "The last appearance of the wheat was in 1885." Sickly and stunted the wheat struggled for a few years against the choking weeds that grew and flourished so vigorously until its very existence became a thing of the past. Here is a lesson full of import to many a Canadian farmer.

Lecture 2. Agricultural chemists have determined that of all the elements of plant food, three may be termed essentials, since they must

be continually returned to the soil in order that its fertility may be maintained. These are Nitrogen, Phosphoric acid and Potash. In this lecture Mr. Warington discusses the character of the nitrogen-holding material in the soil under three heads, 1. Ammonia ; 2. Nitrates ; 3. Nitrogenous organic matter. The relative and absolute amounts in which they exist and the circumstances that control their increase and decrease are given at length. He shows that while the two former are the most readily available forms for plants, it is in the organic matter of a soil that the great bulk of the nitrogen is stored up. The accumulation of nitrogen in the surface soil takes place to a greater extent on prairie and pasture land than in arable soils ; and further Mr. Warington says that "for the present we cannot, I think, affirm that soils are enriched by the free nitrogen of the air, except through the medium of a leguminous crop. A diminution of surface-soil nitrogen takes place when organic matter is in excess and air freely penetrates the soil, since the conditions are then most favourable to the growth of those organisms whose function it is to oxidise the nitrogenous organic matter. Hence, the richest soils are those most liable to waste and demand the greatest exercise of the farmer's skill to preserve their condition.

Lecture 3. Treats of a very important maker, viz. Nitrification, or the conversion of the nitrogen of the soil humus into the soluble nitrogenous food of plants. Schlösing and Müntz showed that this was due to the action of an organized ferment and Warington by experiments carried on simultaneously confirmed their conclusions. This living micro-organism has been succesfully isolated and studied by Dr. Frankland, Winogradsky and Mr. Warington. The most favourable conditions for this process of nitrification are here discussed at length. Briefly, they are the presence of phosphates, a slightly alkaline condition of the soil due to lime or other salifiable base, "a liberal supply of oxygen, the absence of strong light" and a temperature about 98° F. We here find the explanation of the fact so well known, viz., that the addition of marl or chalk (carbonate of lime) in moderate amounts to a soil and especially to one rich in humus, is of great value in increasing crop yields.

Lecture 4. NITRIFICATION AND DENITRIFICATION.—The conver-

sion of the organic matter of a soil into nitrates is the result of the life functions of two organisms—the one a purely nitrous ferment, *i.e.*, capable only of oxidizing ammonia and nitrogenous humus to nitrites and not to the fully oxidized form of nitrates, the other, known as the nitrite ferment, whose function it is to convert nitrites into nitrates. This nitric organism completes the useful work of nitrification. By an immence amount of bacteriological study Mr. Warington at last succeeded in isolating, growing and photographing this highly interesting plant. He says, "in soil, both organisms are present in enormous numbers and the action of both organisms proceeds together as the conditions are favourable to both." *Denitrification* or the destruction of nitrates takes place in water-logged soils from which the air is necessarily excluded. This is brought about through the agency of a third living organism, and the conditions most favourable for its development are an absence of oxygen, and an abundant supply of readily oxidizable organic matter. The practical lesson from this conclusion is the necessity of well-drained land, in order that the surplus water may be carried off and the air allowed to freely permeate the soil.

The nitrates are developed in the upper layers of a soil, but being extremely soluble are washed down by heavy rains to the subsoil. Ploughed land, well drained, loses nitrates when not cropped, and more so especially in wet seasons. Bare fallow does not, therefore, entail an unmixed good. In this connection Mr. Warington says, "If a farmer could ensure dry seasons, so that the nitrates produced by a bare fallow should remain in the soil available for the succeeding crop, it would pay him better to have an alternation of wheat and bare fallow rather than to grow wheat continuously. However, in the English climate no such favourable results can be expected," as the results of 30 years' experience at Rothamsted have shown that "wheat after fallow, except in some of the earliest years, has not given the double produce which should result from the presence of a double supply of nitrates." By a system of drain gauges Mr. Warington has been able to measure this loss of nitrates. He says, "The average quantity of nitrogen as nitrate discharged from the soil during thirteen years has been for the 20-inch gauge 37.3 lbs, for the 40-inch gauge 32.6 lbs., and for the 60-inch

gauge 35.6 lbs. per acre, equivalent respectively to 239, 209 and 228 lbs. of ordinary sodium nitrate. This, then, is the amount annually produced (and lost) in land left for many years unmanured, lying in its natural state of consolidation, and receiving no aëration from tillage. All vegetation that appears on these soils is removed."

Lecture 5. Deals with the "Nitrification of Soils and Manures." In it Mr. Warington points out by means of tables that the greatest loss of nitrogen as nitrates by drainage takes place during those months when the soil is not covered by a growing crop. "In June it is rare to find nitrates in this drainage water. Out of the twenty-five samples of drainage collected in June, July and August during twelve years, only three contained any nitric acid. In September, the crop being now removed, nitrates are always found in the drainage water. In a wet season the maximum amount of nitrates will occur in October. The proportion of nitrates will be maintained with little diminution during the winter months and begin to fall again in March." The crop, therefore, which has the longest growing season will be the best to conserve the nitrates in the soil. "From this point of view maize (Indian Corn) is a more economical crop than either wheat, oats or barley, its growing period extending during the whole of the summer." This lecture is brimful of practical information of a most valuable nature, and the inclination is strong to make very copious extracts, but a few more must suffice. The explanation why the cereals more especially respond to the application of soluble nitrogenous manures is given in the following words: "After a wet winter cereal crops begin to grow in a soil impoverished of its nitrates, and the growth of most cereals is over before the summer production of nitrates is half accomplished. Cereal crops are then especially benefitted by nitrogenous manures, and particularly by the application of nitrates, while for the reason already given, maize is more independent of such manuring than wheat or barley. The beneficial influence of a dry winter upon the crops of the ensuing year is now generally recognized." Mr. Warington gives scientific reasons for practicing rotation, and shows how a proper succession of crops tends to preserve and use the nitrates. This lecture proceeds to give the loss of nitrates in soils fertilized with different manures and cropped with wheat and barley. He summarizes his

conclusions in the following words: "The most striking results we observe are (1) that manuring with ash constituents alone increases the production of nitrates in the soil; (2) that the bigger crops grown by ammonium salts or sodium nitrate, with ash constituents, are followed by an increased production of nitrates; (3) that the use of an organic manure like rape cake or farmyard manure is attended with a large increase in the production of nitrate, even after the first active stage of nitrification is long past.

The concluding chapter is on the "Nitrification of manures." Salts of ammonium (chloride or sulphate) are of nitrogenous fertilizers the most readily nitrified in a soil Carbonate of lime assists most markedly in this process and Mr. Warington is of the opinion that lime or other salifiable base is deficient in those soils upon which ammonium salts do not act beneficially as a fertilizer. It would appear that guano is very easily nitrified. Müntz and Girard place it in this respect next to ammonium salts; "following guano come green manures (lucerne and lupines,) which compared with other forms of manures, appeared to be especially active in clay soils; the third class includes dried blood and meat and powdered horn; far below these stand poudrette, wool and leather."

Lecture 6. Drainage and well waters. This lecture has for its subject the consideration of the chemical composition of the drainage and deep well waters at Harpenden, as well as a detailed account of experiments on the movement of water in soils, with a discussion on the results obtained therefrom. As the wells are all sunk in the chalk, which lies comparatively close to the surface at Rothamsted, their waters will not be altogether comparable to those from wells on Canadian farms. A detailed account of this work will not therefore here be necessary. To the chemist however, if not to the practical agriculturist these data are intensely interesting and exceedingly valuable

We should very much like to see these lectures published in Canada in order that the agriculturists throughout the Dominion could obtain with facility copies for study. All progressive farmers must now make themselves conversant with these and kindred subjects, and those who wish to be thoroughly posted to date on the important question

of nitrification should carefully read this succint account by Mr. Warington of the classic researches at Rothamsted.

Next year the second course of lectures will be given, and I think that our agricultural authorities should well consider the advisability of asking from the trustees of the Lawes Agricultural Trust for their delivery, or at least their publication, in Canada. Ours is a British Colony, whose chief industry is agriculture, and I feel sure that Sir John Lawes and his co-workers would be wishful for his fellow country men in this way to participate in the results of their labours.

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EXCURSION III—TO NORTH WAKEFIELD, QUE.

SEPTEMBER 3RD, 1892.

Two hundred and twenty-eight members and friends of the Club left the Union Station on Saturday, the 3rd day of September to attend the third of the series of regular excursions for the present summer.

La Pêche Village, North Wakefield, was the place selected by the Excursion Committee and recommended to the Council of the Club. All arrangements having been completed, the party left the city at 10 a m. and crossed the Ottawa River on the Ottawa & Gatineau Valley Railway, and then proceeded northward to Ironsides and Chelsea. Then plunging headlong into the picturesque country of the Laurentide hills, along the eastern edge of Table Mountain, Kirk's Ferry, the Cascades, and many other enchanting spots were passed in rapid succession. In less than an hour the excursionists were at North Wakefield, where a long line of dwellings, skirting the shore of the Gatineau River, form the village which is situated in the inner curve of a large circle which touches the round and crescentic hills, lending a peculiar aspect to the whole country.

Mr. F. T. Shutt, M. A., the Acting President, then addressed the gathering and gave out the programme, naming the leaders in the different branches and the most interesting spots to visit.

The time for *rendez-vous* was given for four o'clock at the School House near the bridge on the Pêche River. As the noon hour was

fast approaching the first thing discussed was the contents of the lunch baskets. Under the verdant boughs and in shady nooks of the beauteous and abundant vegetation, all around there could be seen many a group of Naturalists enjoying the mid-day meal in the open air, the blue canopy of a charmingly warm and delightful early September sky o'erhanging all.

At about one o'clock the different parties began to ascend the hillside, the botanists, geologists and entomologists vieing with one another as to who would get to the top first and would obtain most material of interest. Many a group of observant students of nature could be seen halted along the hillside and surrounding the leaders, who there on the spot, would examine and describe the plants or rocks and formations of the locality, and explain the interesting forms and phenomena visible. It was nearly five o'clock before the party had returned and gathered at the School House, where a number of addresses were given, as is the custom on these occasions.

The first to speak was Mr. J. Fletcher on "Insects and Insect Life." There were two kinds of insects noted and described—the *beneficial* and the *noxious* insects. These comprised many species and genera. Mr. Fletcher described many of these and gave ready rules whereby beneficial or noxious insects might be distinguished, pointing out the economic relations and significance of these creatures in the world. He exhibited several kinds of plant-galls and described the insects which caused them, he also spoke of the parasitic and guest insects which are found in large numbers in galls of all kinds. The great value of parasitic insects in the economy of nature was illustrated by an account of the good services performed during the past season in Western Ontario where almost every specimen of the Grape Vine Sphinx and the Tomato Sphinx was found to be parasitised by enormous numbers of a small enemy called *Apanteles congregatus*. No less than 207 of the latter having emerged from a single Caterpillar of the Tomato Sphinx. The egg parasites of insects, *Proctotrypidæ*, were also described, and an interesting account was given of the egg-parasite of the too-well known Currant worm, *Nematus ribesii*.

Then followed Mr. R. B. Whyte, leader in Botany. In his usual happy manner he described the plants that were observed and collected

during the day, mentioning the salient characters and peculiar habits of several of these, as also their usefulness to man and other creatures. He had observed that a very large proportion of our commonest plants in open places were introduced from Europe. Many of these, as the thistle for instance, had become very noxious weeds. The majority of plants met with during the day were common-place specimens. Upwards of sixty different species were observed and noted in blossom. Of these the Golden-rods and Michaelmas Daisies formed a conspicuous lot. The following representatives of the Golden-rods (*Solidago*) and Michaelmas Daisies (*Aster*) were jotted down.

Solidago squarrosa.	Aster cordifolius.
" bicolor, v. concolor.	" diffusus
" rugosa.	" puniceus.
" Canadensis.	" macrophyllus.
" lanceolata.	" paniculatus.
" latifolia.	" Lindleyanus.

Epiphegus Virginiana and Rudbeckea hirta, one very humble and the other a very conspicuous flowering plant were also collected and are worthy of note. Of trees, the elm, linden, maple, oak and birch trees are conspicuous and beautiful at North Wakefield. It is expected that the list of species observed on this occasion will be greatly increased on some future visit by the Club to the locality.

Prof. Macoun was then called upon to address the gathering, and dwelt at length upon the relation of knowledge acquired from books and of that acquired from personal observation and contact with Nature. He also described the forest trees which were to be seen all about, and applied the principles he had laid down in determining these at a distance.

Dr. Henry M. Ami spoke next. In a rapid manner, as the time for re-assembling at the station was fast approaching, he gave a general sketch of the geology and physical geography or history of the district. The rocks consisted chiefly of a hard compact, more or less coarsely crystalline, syenite, or Hornblendic granite, with a tendency to lamination or foliation, resembling gneiss. This primitive or Laurentian rock —fundamental gneiss, sometimes called—was seen to be intersected by a small dyke of dark hornblendic material, resembling a dolerite,

fine grained and compact, rather tortuous in its course, but in a general north-east and south-west direction. From the summit of the mountain north-west of Wakefield Village, the valleys of the Gatineau and Pêche Rivers could be seen, and Table Mountain lay to the south some 8 or 10 miles distant. In the lower portion of the Pêche River valley the rocks were found to be glaciated, grooved and polished during the "Great Ice age," by the Pêche glacier which used to descend and meet a larger one in the present Gatineau River valley. It deposited morainic drift along both sides of the valley, but left little along the points and curves of this meandering valley. Whilst the summit of the mountain itself is rounded, but not grooved nor polished, the gneissoid rocks along the road and below the mills are beautifully polished, indicating the existence of a glacier.

In bringing the pleasant excursion to a close Mr Shutt congratulated those present on the charming outing they had all enjoyed. He said that this would probably be the last of the Summer excursions, but that Dr. George Dawson, the President, had now returned to Canada and doubtless he would be untiring in his efforts to assist the Soiree Committee in arranging a good programme, for the winter meetings, which would appear in the OTTAWA NATURALIST shortly. He trusted that the large attendance at the summer excursions might be taken as an earnest of what we should see at the winter meetings.

The city was reached at 7.30 after a rapid and pleasant journey.

A water-colour sketch of the bridge and Pêche River, made by Miss Lizzie Perkins, a member of the Club, was much admired by all who saw it. Mrs. Chamberlin was also busily engaged in adding to her now extensive collection of paintings of native fungi, and secured some valuable specimens through the kind services of Prof. Macoun.

H. M. A.

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ORNITHOLOGY.

Edited by A. G. Kingston.

Albinism in the "English Sparrow" (*Passer domesticus*).—As time goes on and this introduced species comes more thoroughly under the influence of our dry climate with its extremes of temperature, the appearance of occasional individuals lacking the usual quantum of colouring matter in parts of the plumage seems to grow more frequent. From colonies planted in Boston and New York about thirty years ago, the sparrow made its first appearance in this northern latitude about 1872. Until recent years a sparrow showing white markings (apart from the normal pattern of the species) was looked upon as a rarity; now almost every large flock about the streets and gardens, if closely examined, will be found to contain at least one bird with here or there an odd white feather.

These marks are generally irregular, but occasionally a definite pattern is noticeable. The writer has in his possession a specimen, taken in May last, in which the secondary wing-quills are wholly white and the tail white with a slight bar of grey at the tip. Mr. Fletcher reports having seen one of somewhat similar plumage a few days ago in Ann Street. The following patterns have also been observed:—

(1) A male with the usual black patch on the throat surrounded with a border of white, which also extended as a white collar around the neck.

(2) One with white secondaries.

(3) One with two parallel white stripes between the shoulders.

(4) One with the whole crown white.

Any of the readers of the Naturalist who may observe cases of albinism, or of the opposite peculiarity, melanism, an undue darkening of the plumage, in sparrows would confer a favour by sending a short note to either of the leaders of the Ornithological Section.

Migration Notes.—The migration of birds is to most persons one of those mysterious movements of nature which they are compelled to believe in, but whose processes can hardly be expected to be made evident to the senses. Our feathered visitors disappear in autumn and return to sight in spring, but the number of persons, even among those

most interested, who have ever seen a flock of migrants in their northward or southward flight is remarkably small. With the exception of some of the larger waterfowl and hawks, nearly all birds of passage pursue their journey at night, and generally at a great height in the air. From observations made a few years ago at an astronomical observatory near New York, upon migrants seen with a telescope passing across the face of the moon, it was calculated that these birds were flying at a height of from 1 to 4 miles above the earth. The theory now pretty generally accepted by those who have made these movements a study, is that the birds are guided in their course by rivers and the sea coast, the line of water being easily traceable by moonlight or starlight on a clear night, even at these great altitudes. When the weather is dull or stormy, however, and especially when a haze hangs low down, obscuring the landmarks, the travellers are forced to fly low. At these times, although it is not often possible to see them, their rallying calls may frequently be heard with great distinctness.

One of the best points about Ottawa for such observations is the Maria Street bridge over the Rideau Canal. The Gatineau River to the northward with the first stretch of the Rideau on this side, form an almost due north-and-south line for about 250 miles, and no doubt compose one link in the chain of landmarks followed by the birds in passing between the Hudson Bay region and the Atlantic coast of the Southern States. On almost any dull night during the season of migration—April and May for the northward movement and September and October for the southward—at an hour when the noises of the streets have somewhat quieted, the cries of the passing birds can be clearly heard. Very often too, the direction of the flight of certain individuals or small groups may be traced with reasonable certainty, showing the course at the former season to be "down" the canal, i.e. north-westerly at this point, and in the autumn months in the contrary direction. The identification of species in the darkness is a more difficult matter. The rallying cries of most birds differ considerably from the songs and calls which we know so well in the daylight. Still there are a few species whose voices are familiar enough to be recognized at any time. The cry of the Greater Yellow-leg Plover (*T. melanoleucus*) is at once striking and easy to imitate, as every sportsman knows. One night last fall this

call was heard, and on imitating it the writer had the satisfaction of eliciting an answer several times repeated as the bird passed on up the canal. This year the nights of the 15th and 18th September were marked by a great movement of birds. On the 15th at about 10.30 p.m. there was a fine rain driving before a south-westerly wind, and the birds flew unusually low. They seemed from their cries to be chiefly warblers and sparrows (native) though sometimes the cries of various shore-birds could be heard at a greater height. Frequently small birds of the warbler family, struggling with the storm, would almost dash against the electric lamp which stands upon the bridge, circle a number of times round it and then pass away into the darkness. The night of Sunday, the 18th, was more favourable for the identification of species. Shortly after midnight a thunderstorm came up from the south-west, and during the dull quiet period which preceded it the calls of the passing birds were so frequent and distinct as at times to become a positive clamour, attracting the notice of casual passers-by, who would stop and look up into the darkness in astonishment. The voices of the Robin, the Bluebird, the Goldfinch and the Greater Yellow-legs above mentioned could be recognized, and other calls, though not to be identified, were clearly assignable to the warbler family, the *limicolæ* (snipe and plover) and various native sparrows. The main column of this army of birds evidently confined itself to the immediate neighbourhood of the canal, for at a distance of a few blocks on either side, the cries became much less frequent, though once in a while a bird or two evidently confused by the multitude of lights, would fly out in wide circles over the city screaming distractedly. Probably another column might have been found following the parallel course of the Rideau River about a mile to the eastward until it and the canal converge and meet a few miles south of the city. In the city papers on the following Monday reference was made to some of these phenomena, and at least two birds (partridges) were reported to have been found, killed no doubt by striking electric wires or posts.

Several nights following this were clear, and no migrants came within "earshot." That of the 22nd was to all appearances similar to the 18th, but no movement was discernible. On the 24th the birds were again on the wing, though not in such numbers nor so clearly to be heard as on the previous occasion.

ENTOMOLOGY.

EDITED BY W. HAGUE HARRINGTON.

The cool nights and light frosts which occured in September have had a marked effect on the abundance of insect life. On bright days Clouded Yellows and White Cabbage Butterflies have been abundant, and towards the end of the month a third brood appeared of both the Nettle Butterfly (*Vanessa Milbertii*) and the Camberwell Beauty (*Vanessa Antiopa*). After a few trials of their newly gained wings, these gems of the summer landscape will seek some quiet nook in cave or hollow tree, and sink into a state of torpor from which they will only be aroused by the returning warmth of opening Spring. On Sept. 25th a single specimen of Peck's Skipper (*Pamphila Peckius*) was seen sipping the nectar from a stalwart Michaelmas Daisy (*Aster puniceus*).

Several caterpillars were sent to the leaders during the month. Hidden in a den made by catching together two or three leaves of *Salix cordata* or other rough-leaved willows, the solitary caterpillars of *Niso niades Icelus* were several times found. These have pale green slug-shaped bodies with large brown heads, separated from the body by a small neck. They apparently pass the winter in the caterpillar state.

The beautiful black, yellow and white Zebra caterpillars of *Mamestra picta* have been very abundant and destructive. Their numbers, however, have been much reduced by a minute parasite of the Proctotrypid genus (*Trichogramma*) which passes all its preparatory stages inside the egg. The moth which lays the egg from which the Zebra caterpillars hatch, deposits from 100 to 250 in a flat patch on the under side of a leaf. Of over twenty of these patches collected in the beginning of September, not a single egg produced the caterpillar, but instead the minute parasite above named. The same microscopic benefactor, or a closely allied species, did good service in destroying the egg of the Imported Currant Saw-fly, and of a new imported enemy of the willow which has only lately appeared in America in the shape of another Saw-fly (*Nematus pallidiventris*). The event of most importance in this line is the sudden and wide-spread appearance in Canada of the Cattle Horn-fly (*Hæmatobia serrata*). The habits and the best remedies for this pest are all given in the recently issued Bulletin 14 of the Central Experimental Farm.—J. F.

BOTANY.

Edited by William Scott.

Aster Novæ-Angliæ, varietal forms (1).—The only station in the vicinity of Ottawa for this fine Michaelmas Daisy is Casselman, where some clumps bearing flowers of a beautiful pure white were found on Sept. 10. growing with the ordinary form.—W. S.

(2) Another beautiful form was brought from Toronto by Dr. J. E. White, bearing flowers which varied from pale mauve to deep lilac. The flowers which opened first were deepest in colour.—J. F.

Gentiana saponaria.—Dr. White also brought with him to Ottawa fine flowering specimens and living roots of this rare Gentian. The roots, with some other rare plants presented by Dr. White, are now planted in the herbaceous border of the Botanic Garden at the Central Experimental Farm.—J. F.

Helianthus decapetalus.—A noticeable feature of the Ottawa woods in Autumn is the absence of all species of wild sunflowers. *H. decapetalus*, however, occurs at Casselman and is apparently becoming more abundant there than formerly.—W. S.

Glyceria elongata.—This is one of our most local grasses. It has been found sparingly at Kingsmere, but at Casselman it occurs in almost every damp gully.—W. S.

Potato Rot.—A good object lesson demonstrating the value of scientific knowledge, is to be seen just now at the Experimental Farm. Some potato plants which were twice sprayed with Bordeaux Mixture to prevent the blight are now perfectly covered with green leaves, while all the others around them, and even in the same row, which were not treated, have been brown and dead for three weeks.—J. F.

Umbrella Mushrooms.—Those botanists of the Club who are lucky enough to know the gastronomic qualities of *Coprinus comatus* have lately enjoyed many dishes of this delicious mushroom. No other fungus resembles it. The shape is at first elongated oval or egg-shaped, but later like a half-closed umbrella, from 3 to 10 inches in height, white when young and covered outside with small brownish hairy tufts. When old it deliquesces into a black inky fluid.—J. F.

MINERALOGICAL NOTES.

MANGANESE ORES IN CANADA, by H. P. Brumell, Ottawa.—The August number of the *American Geologist* for 1892, contains an interesting as well as useful contribution regarding the distribution, origin and geological relations, as well as economic uses and value of the ores of manganese in Canada.

We are informed here that all the known workable deposits are located in New Brunswick and Nova Scotia, and belong chiefly to rocks of the lower carboniferous age, whilst the "bog ore deposits, being of recent formation, are found overlying rocks of any formation from the Cambrian upwards."

From the Markhamville deposit of crystalline ore, Mr. Brumell informs us, upwards of 20,000 tons have already been shipped. The analyses of this ore are also given, and reference made to another important deposit in the same (Sussex) County in New Brunswick, at Jordan Mountain, where some 400 tons of from 80 to 85 per cent. ore have been extracted from the western side of this mountain. At Quaco Head and Gowland Mountain crystalline ores of manganese also occur. At the latter locality it "consists principally of psilomelane and fills the interstices of a very much broken and partly decomposed granite of Pre-Cambrian age." Upham, Waterford, near Petitcodiac, Springfield, Tête-à Gauche Falls and Albert County. The Shepody Mountain deposits have been described by Dr. R. W. Ells in his report (1884) and shows that the ore "consists of pyrolusite and psilomelane, and occurring in the base of conglomerate in irregular pockets."

"Wad" is the common name which miners give to that ore of manganese which is found in swampy districts, and is of recent origin and still in process of formation in many places.

The most important deposits of "wad" occur at Dawson Settlement in Albert County, N. B, "where many acres of ore are found, the beds varying in extent and depth, and attaining in some places a thickness of over forty feet, to which point they have been proved." Analyses of this easily worked ore are then given by Mr. Brumell from the reports by Messrs. W. F. Best, of St. John, N. B., and John Burwash, showing the percentage of manganese binoxide "to vary from 35.5 to

vary from 73.6; the average being about 60 per cent. So much for New Brunswick ores.

In Nova Scotia the production of manganese is not so great, although the mode of occurrence and treatment of the ore is similar to that in New Brunswick. Pyrolusite—the high grade ore of manganese—is more widely distributed. "On the south shore of Minas Basin and midway between Noel and Walton, is situated the best-known and most important manganese mine in Nova Scotia, the Teny Cape mines, which, since its discovery in 1862, has been operated more or less continuously." Pyrolusite and manganite occur here, and assays are given of specimens from "Teny Cape," "Cheverie" and "Douglas" locations, made by Dr. Howe, E. Gilpin, Jr., and H. Poole respectively. These indicate 85.54, 90.15 and 84.62 per cent. of manganese oxides present in ihe ore.

On Cape Breton Island, the Hon. E. P. Moseley, of Sydney, C.B., has discovered and developed deposits of pyrolusite which promise well. they are situated near Loch Lomond, and Mr. Brumell adds the report made by Mr. Hugh Fletcher, of the Geological Survey staff, in his report, addressed to the Director. for 1882-83-84. Upwards of 91 per cent. of manganese dioxide occurred in this ore according to an analysis by Mr. Frank Adams.

Ontario and Quebec, etc., afford but small deposits of manganese ores. In Stanstead and Bolton Townships, in Quebec, and in the Magdalen Islands (teste J. Richardson in his report for 1879-80), as well as near Batchewaherung Bay, Lake Superior, in Ontario, together with a band of manganiferous spathic iron ore in the Nastapoka Istands off the east side of Hudson's Bay, appear to be the only places where ores of manganese are yet known outside of the Maritime Provinces.

Fossil Remains.—It might be added here that a number of fossil remains have been found in Nova Scotia and New Brunswick entirely filled and the hard parts replaced by pyrolusite. Amongst these is an interesting ann well-preserved specimen of a pteropode (Conulara allied to B. planpcostata, Dawsan) from the Lower Carboniferous of Springfield, where it was collected by Mr. A. E. Barlow in 1884.

H. M. A.

EDITORIAL NOTES.

THE PRESIDENT.—We are much pleased to welcome safely back again Dr. George M. Dawson, C.M.G., F.R.S., &c., our President, who has just returned from England where he has been engaged for five months in connection with the Behring Sea arbitration. We congratulate Dr. Dawson upon the important work which has been entrusted to him by the Imperial authorities, and also on the latest honour which it pleased Her Most Gracious Majesty the Queen to bestow upon him last May in recognition of his many services to science. This last distinction was Companion of the Order of St. Michael and St. George. (C.M.G.)

DR. ADAMS.—Mr. Frank D. Adams, M. App. Sc., and late of the Geological Survey Staff at Ottawa, spent the summer in Germany where the University of Heidelberg conferred upon him the well-earned title of Doctor of Philosophy (Ph. D.).

SCIENCE-TEACHING AT OTTAWA.—At the last general excursion of the Club to La Pêche, there were no less than 80 students from the Normal School. This speaks well indeed for the Science Master at this institution, and shows plainly that Mr. William Scott is not merely a teacher from text books, but leads his students out into the fields, where alone can be acquired a practical acquaintance with the objects which they have to study. No greater compliment than this, we think, could have been paid Mr. Scott by his pupils, and we feel sure that he must have been much encouraged by this practical and well-merited expression of approval of his method of teaching. We hope that at some future time the Science Master of the Collegiate Institute may also see the benefit of availing himself of the advantages offered at the Club meetings of furthering the important work with which he is entrusted.

AUTHORS' EXTRAS.—At a recent meeting of the Council of the Club it was decided to give to any member who contributed an article of more than two pages in length, ten copies of the number of the OTTAWA NATURALIST which contains his article, upon his making application to the Editor or the Librarian at the time of publication.

THE WINTER LECTURES.—The Soiree Committee will be pleased to receive from members, as soon as convenient, the titles of any papers which they may wish to read before the Club during the coming winter, and at the same time an intimation as to the time which will be most convenient.

CASTOROLOGIA —The Editor begs to call the attention of readers of the OTTAWA NATURALIST to the advertisement of the above work on the last page of the cover. This work is by Mr. Horace T. Martin, of the Montreal Natural History Society, who gave us the pleasure of his company at our Spring Excursion to Butternut Grove in 1889, and spoke so acceptably to the members of the Club. Mr. Martin has made a most careful study of his subject, and has had peculiar facilities for getting information. He is a pleasing writer, and we feel sure that all who obtain his work will be satisfied.

THE GEOLOGICAL SOCIETY OF AMERICA.—Prof. H. L. Fairchild, of Rochester, N. Y., Secretary of the Geological Society of America, has sent the following notice to the Fellows of that society with reference to the next meeting :— "In response to a cordial invitation from the Royal Society of Canada and the Canadian Geological Society to this Society to hold its next meeting in Ottawa, the Council has determined that the fifth winter meeting shall be held in the City of Ottawa, beginning December 28th, 1892."

As a large number of the members of our Club take a deep interest in geological matters, professionally and otherwise, it is anticipated that the geologists from all parts of the North American Continent who will be present on that occasion will meet with a hearty reception at the hands of our members. Ottawa possesses sufficient attractions and interest in geology to make this meeting one of the most successful ever held.

Papers bearing on the geology and history of various parts of this Continent will be read, the discussions of which will doubtless be both profitable and interesting.

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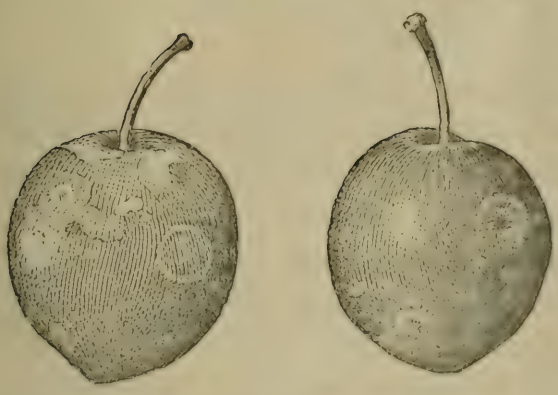
A DESTRUCTIVE DISEASE AFFECTING NATIVE PLUMS.

Cladosporium carpophilum, (v. Thümen.)

By John Craig.



(*Cladosporium carpophilum.*)

During the past two years many complaints have been received from farmers and fruit growers in regard to a disease which has caused their red plums to shrivel and drop quite suddenly when almost mature. In many sections during the past season the crop has been an entire failure. As the disease appears to be spreading, it would seem that in the near future very active measures should be instituted to check its increase.

Prof. L. H. Pammel, of the Iowa Agricultural College, who has given the disease special study, has kindly supplied me with the following facts, which I quote in his own words :—

" My first acquaintance with this disease as affecting our cultivated plums was in 1889.[1] The disease having appeared very destructive to certain plums since that time, and the fungus has been on the increase.

This spotting is caused by a parasitic fungus, *Cladosporium carpophilum*, which is abundant on peaches, especially on the later varieties. So injurious is it to certain varieties that Dr. Smith[2] finds that it not only injures the appearance of the fruit somewhat, but when very abundant the flavour also. I have heard growers in Texas speak of it as nothing serious, but to my mind there is no question that it greatly lessens the crop, and also causes a cracking of the fruit as Dr. Smith finds, making it especially subject to the attacks of *Monilia fructigena*. Several other species of *Cladosporium* are troublesome, the *C. cucumerinum*, Ell. and Arth. is troublesome to cucumbers. Several species

1. Meeting of Iowa Academy of Sciences, Sept. 5, 1890.
2. Journal of Mycology, Vol. V., p. 32.

are troublesome to grapes. The *C. viticolum*[3] occurs on *Vitis labrusca*, and *V. vinifera*. A species was common in New York, in Clinton,[4] according to Mr. Fairchild. *C. roesleri*, Catl. on the European cultivated grape (*Vitis vinifera*) in Europe.[5] The Apple Scab (*Fusicladium dendriticum*) is a fungus closely related to the plum fungus,[6] and without doubt will seriously threaten plum culture.

The spots are visible in half ripe plums as small pale greenish or yellowish patches not larger than a pin head. They increase in size, becoming in some cases half an inch across. Some of the older spots may become confluent, forming one large more or less radiating patch. Patches may be formed in nearly mature plums. In old specimens which have been kept moist for some time the spot becomes darker in colour, almost black, more irregular and raised.

Microscopic examination of the affected portions of the plum shows a nearly colourless mycelium creeping over the surface or vegetating between the cuticle and the remainder of the epidermal cells. In the darker portions occur the septate hyphæ, these occasionally come through the cracks in the cuticle. In older material a dense stroma of short brown hyphæ appears between the cuticle and cellulose layers of the epidermal cells. The small spores are oval in shape, pointed at the end and usually two-celled, and are borne at the end of the conidiophore, or laterally. They germinate readily when placed in water.

The chief injury caused by this fungus is the cracking of the plums, allowing *Monilia fructigena* a chance to work. The injury, however, does not extend much beyond the point of attack and only a small number of the plum cells become brown. The fungus, no doubt, also, checks the development of the plum, and in the severer cases it causes a shrivelling of the fruit. The fungus seems to occur on all

3. Soraner Pflanzen Krankheiten, Vol. II., p. 401.

4. Jour. of Mycology, Vol. VI., p. 99, Scribner, Diseases of the grape vine. Bull. 2, Dept. of Agricul., Rep. 1886, p. 3. Galloway, Jour. of Mycology, Vol. V, p. 93.

5. Soraner Pflanzen Krankheiten, Vol. I., p. 401.

6. See Bailey. The cultivated native plums and cherries, Bull. 38, Cornell University, Agrl. Experiment Station, p. 54. Pammel, Jour. of Mycology, Vol. VII., p 99.

kinds of the American plums. Here at Ames I have noted it on the following species and varieties: Pattowattamie (*Prunus augustifolia*), Miner (*Prunus hortulana*, var. *Mineri*), Maquoketa, DeSoto, Rollingstone, Speer, Chippeway, Black Hawk, Hen Plum (*Prunus Americana*), Sloe Plum (*Prunus spinosa*). Mr. F. C. Stewart reports this fungus at Greenfield, Iowa, on wild and cultivated plums, in some cases it ruined half the crop. I have also seen it very common on wild plums at Cedar Rapids, Iowa, and Mr. Stewart also found it at Marshalltown, Iowa. Mr. Geo. W. Sturtz reports it at Plainview, Nebraska, and Mr. John Wragg at Nankee, Iowa, and my friend, Prof. Craig, of Ottawa, Canada, writes me that it was common in Minnesota on cultivated Cheney, DeSoto, Rollingstone and Speer; That it also occurs on the common Wild Plum and cultivated varieties in Canada; also in Virginia on *P. Americana*. It did not appear at the Experimental Farm, Ottawa, in 1891. From this it will be seen that this fungus has become widely distributed and destructive. The disease is certainly on the increase. It did not appear to any extent this year here at Ames, except upon a few chickascaw and sloe plums. As plums fruited but little, I have not seen it attacking *Prunus domestica* at Ames. The *Cladosporium* has become a serious enemy to cherries, first noticed in 1891 when it destroyed from 2 to 10 per cent. of the crop. First appearance is marked by a pale coloured spot not larger than a pin head, which increases in size, and finally is olive green in colour. As in plums a crack is frequently found extending across the patch. The cherries are also badly shrivelled in many cases, somewhat bitter and sour. We noticed the following varieties affected in 1891: Cerise Ostheim, Spate Amarelle, Shadow Amarelle, and Wagner, and in 1892, although the cherry crop was small, the disease appeared on many cherries; my assistant Mr. Stewart has furnished me with the following list: Lutooka, Shadow Amarelle, Schatten Amarelle, Spate Amarelle. It will be noticed that this list only contains Russian varieties. Most of the cherries grown on the college grounds are Russian. Early Richmond growing not far from the college was not affected by the disease; it may have appeared in other places, but I have not heard of any, or at least specimens were not sent to me. Experiments with fungicides would have been made this

season, but the plum and cherry crop was almost a failure and hence no experiments could be made.

As this fungus works very much as Apple Scab there is no reason why the fungicides for that disease should not prove effective. But treatment should begin soon after the petals have fallen, and should be continued till nearly the ripening period."

In addition to the remedies recommended by Prof. Pammel I would suggest the use of a weak solution of copper sulphate, say 1 oz. in 25 gallons of water.

I shall be glad to receive any additional data regarding the progress and life-history of this fungus. It is of special importance to fruit growers in the Ottawa Valley where we are debarred by climatic conditions from growing many of the *Prunus domestica* family of plums bearing fruit of finer quality but less vigorous and hardy in constitution.

It may be mentioned that this is a new disease and although it has received considerable attention from economic botanists during the last three or four years was only described by Felix von Thümen in 1887.

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ORNITHOLOGY.

EDITED BY A. G. KINGSTON.

SNOW BIRDS.—The first Snow birds of the season were seen on the 24th October, when a large flock of about 200 alighted on the Experimental Farm. Another flock was noticed by Mr. John Craig at St. Hubert, Que., on the 22nd October.—J. F.

NATIVE SONG BIRDS.—Mr. Charles Hughes, who has been spending the summer at Wakefield, in the Laurentian Hills has been studying our native song birds. He has promised to send us soon some notes on between 20 and 30 species which he has observed. He kept many of them round his house by feeding them with seeds of different kinds. For this purpose he sowed a large quantity of Sunflower, Millet, Hemp, and Canary-seed, and the pleasing result has been that many kinds seldom seen, have stayed around his residence through-

out the summer. Mr. Hughes has also made collections of insects and other natural history objects.—C. E. D. Chubbuck.

Hudsonian Chickadee (*Parus Hudsonicus*).—A specimen of this rather rare northern bird was seen in an orchard in Ottawa East on the 23rd October.—W. A. D. Lees.

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ENTOMOLOGY.

Edited by W. Hague Harrington.

Calosoma scrutator at Ottawa.—A single wing-case of this magnificent beetle, not previously recorded from Ottawa, was found by Mr. Andrew Halkett upon Parliament Hill. Judging from the fresh appearance of the fragment, the specimen had been recently killed. This species is frequently found in Western Ontario and is sometimes washed up along the shores of Lake Ontario in large numbers, but the only other record from this part of Canada is a single specimen taken by Mr. J. D. Evans at Sudbury, Ont.— J. F.

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BOTANY.

Edited by William Scott.

Autumn Tints.—The foliage this year about Ottawa lacks the usual variety and brilliancy of tints usually seen. Cold weather without frost seemed to hasten the process of decay without bringing out the glowing colours.

On this subject of colours some trees seem independent of weather in the matter of autumnal clothing. *Acer Ginnala*, a dwarf maple from the valley of the Amur River has been as glowing as ever in its garb of bright red, looking in the distance like a ball of fire.

The Red Oak, too, with its rich crimson plumes is always reliable. A row of these, in the Experimental Farm nursery, along side of the yellow gold of the Cut-leaved Birch, presents an effect very pleasing to the eye. Cut-leaved Sumach (*Rhus glabra*, var. *laciniata*) at this time in point of colouring is identical with the sturdy oak, but presents a great

contrast in the delicacy of its outline. Scarcely less conspicuous but of a different shade of red are the bushes of the beautiful dwarf Barberry (*Berberis Thunbergi*) and the different Dog-woods (*Cornus*).

The Purple-leaved Plum still holds its summer garb like the oak and will retain it until severe frost loosens its grasp. The foliage is of a deep maroon-purple. Many shrubs and herbaceous plants when touched by frost take on a purplish shade, this is sometimes very bright on the Red and Silver Maples and the White Ash. In the Smoke Tree (*Rhus cotinus*) the leaves appear to have been delicately washed with rose madder while the Scented Sumach (*Rhus Canadensis*) varies from pale yellow to bright scarlet or purplish bronze.

Bronze prevails to a large extent in the autumn foliage. Raspberries and Strawberries are frequently very beautiful and the Wild Roses are rendered most attractive objects. The heavy rich foliage of the Japanese *Rosa rugosa* is much improved by this autumn bronzing and as it holds its leaves and handsome fruit for a long time it is a useful shrub for ornamental grounds.

Particularly beautiful is the crimson and gold autumn foliage of *Pyrus arbutifolia*, and although less vivid in colouring the golden yellow of the various poplars and hard maples add much to the glory of the autumn landscape.—John Craig, Ottawa.

Impotency of Hybrids.—The fact that many varieties of the Rogers and other hybrid grapes are dependent on cross fertilization was clearly brought out, owing to the peculiar state of the atmosphere during the blossoming period this year. A humid atmosphere with frequent showers prevented in a large degree intercrossing by wind or insects, and consequently we find a number of varieties comparatively unfruitful, which in favourable seasons are uniformly productive.—John Craig, Ottawa.

Anthracnose or Bird's-eye-rot (*Sphaceloma ampelinum*) is creeping into vineyards in the vicinity of Ottawa and may prove very destructive in the future. All diseased wood, leaves and fruit should be burned this autumn and the canes and trellises sprayed with a solution of iron sulphate one pound to 25 gallons.—John Craig, Ottawa.

Fusicladium on Cherry.—It is feared, judging from the indications of last season, that the disease known as "Apple Scab" or "spot" (*Fusicladium dendriticum*, Fckl.), which has thus far principally affected the Apple and Pear, is likely also to prove dangerous to the Cherry. A single variety only was affected in the Experimental Farm orchard this year, but so severely as to cause the loss of the entire crop. Gruner Glas (?) the variety attacked, is one of Prof. Budd's importations from Eastern Europe. Two trees of this variety were growing vigorously and were heavily laden with fruit which was nearly mature when the disease was first noticed. Specimens were sent to Mr. D. G. Fairchild, Assistant Vegetable Pathologist, at Washington, D. C., who identified the disease as the true *Fusicladium* of the Apple. The foliage was also attacked but less severely than the fruit —J. Craig, Ottawa.

A Fern New to Canada.—An addition to our Canadian Ferns in the shape of *Asplenium ruta-muraria*, L., has been made this year by Dr. P. J. Scott, of Southampton, Ont., who discovered it growing plentifully on the rocks of Flower Pot Island, about four miles from Tobermorey, a small place near Cape Houd in the north of Bruce Co., Ont. The specimens sent me for determination are very fine and typical. The nearest before known stations for this interesting species were in Vermont and Michigan, U. S.—T. J. W. Burgess, Montreal.

Introduced plants.—The three North Western plants *Helianthus rigidus*, *Lepachys columnaris*, and *Grindelia squarrosa*, which were reported last season by the Botanical Section as having been found near Eddy's old mill-yards at Birchton, were again noted in the same locality a few weeks ago. It does not seem probable that the two first named will prosper in their new home, as no vigorous specimens were met with ; but *Grindelia squarrosa* has evidently struck a very congenial habitat. The number of plants of this species has greatly multiplied since last year while its territory is very considerably enlarged. Many stout thrifty specimens were noticed even on a well-beaten road. An interesting feature of this plant is its profuse resinous-viscid coating.

Several fine specimens of the Walking leaf fern (*Comptosorus rhizophyllus*) were gathered at old Chelsea on Oct 15th. The past season seems to have been very favourable to its growth as it was found

in greater profusion than usual, nearly every shady nook of the calcareous rocks abounding with it. In our region the best specimens are to be had in the late autumn and members of the Club who are interested should seek it without delay.

Last year a large colony of Moth Mullein (*Verbascum blattaria*) was discovered in on old pasture near Mechanicsville, but no trace of it could be seen this summer. The plant is rather scarce in the vicinity of Ottawa, and although it has been found at various points near the city during the past few years, it seems not to persist with any degree of certainty in any one place.

Euphorbia marginata, an annual indigenous to the North Western States, was introduced into the Ottawa district from Dakota some years ago. A few seeds sown in a garden near the city two years ago, produced vigorous plants, which cast their seed in the autumn, and gave rise this year to a numerous colony of sturdy offspring, with every indication of survival of the species. The showy white-margined floral leaves render the foliage rather attractive. It is known among the Dakota Indians as "Snow-on-the-mountain."

A beautiful albino form of *Verbena hastata* (Blue Vervain) was collected recently near St. Patrick's Bridge. There is much to be learned yet about these interesting variations of nature, and if all members of the Club who happen on such specimens would carefully note the surroundings, and grow the plant for future observation, more light might soon be thrown on the matter.—R. H. Cowley.

Albino Liatris.—Some four years ago the Rev. W. A. Burman, at that time working as a missionary amongst the Sioux Indians at Griswold, Manitoba, sent to the Botanic Garden at the Central Experimental Farm, a root of *Liatris scariosa*, which bore pure white flowers. This plant is now growing vigorously, and bears every year several beautiful spikes of pure white flowers. Several plants, however, which have been grown from its seed, flowered for the first time this season, and all of them bore flowers of the ordinary reddish-purple colour of the species. The original plant was grown in a group containing four roots of the ordinary form. Next year it will be separated and seeds again planted, and it will be interesting to find if the white form can be

perpetuated. Seeds of this year's seedlings will also be sown, and these, perhaps, may give white offspring. As in some animals, a second cross may be necessary to produce change from a long established form.—J. F.

Mackenzie River Notes.—During the summer just past Miss Elizabeth Taylor, daughter of the United States Consul at Winnipeg, (who has been well known to Canadians since more than twenty years ago as "Saskatchewan Taylor," owing to his persistent and wise advocacy of that region as the great wheat field of the future), made a trip by the Hudson Bay Company's steamer from Athabasca Landing on the Athabasca River, ninety miles north of Edmonton to Peel River in the delta of the Mackenzie River and far north of the Arctic Circle. The total length of the trip was about 1,500 miles and in a generally northward direction.

Although the trip was not make primarily in the imterests of Botany; but rather to sketch and photograph the wondrous scenes on the mighty Mackenzie, yet, like her father's daughter Miss Taylor could not let such an opportunity pass of adding her quota to our knowledge of the northern land which her father has done so much to bring before the world. The botanical results of her trip were submitted to the writer for identification and a complete set consisting of 170 species of remarkably well preserved specimens was presented to the Museum of the Geological Survey Department.

An examination of the specimens proved conclusively that the warm currents of air that are known to occur in the Peace River country pass down the Mackenzie and account for the occurrence of a flora north of the Arctic Circle that seems in no way different from that which is to be found 1,000 miles to the South. Northern exposures give true arctic species; but these evidently are not the prominent flora of the Mackenzie delta as they are almost wholly absent from the collection. Another feature of interest in this collection is the gathering of specimens in exactly the same localities where Sir John Richardson obtained them 70 years ago and the sight of them side by side with his record of their occurence shows how little we have added to the botanical knowledge of the far north in recent years.

Besides many interesting species that are well known to us, Miss Taylor brought specimens of two plants from Peel River in the Mackenzie delta which may eventually throw some light on the origin of the northern flora. One is a species of Birch which is evidently a good sized tree and which is either identical with a Siberian species (*Betula microphylla*) or is new to science. Ripe fruit of the species was procured and seed has been handed to Mr. Fletcher to be grown in the Botanic Garden of the Experimental Farm, and thus in time, I trust, we shall know exactly what it is. The other species is an Umbelliferous plant related to the genus Ligusticum which may also be new.

This collection is of much interest and demonstrates clearly what good scientific results may be obtained by an observant traveller with a little trouble if only there be a wish to make the most of such opportunities as may arise.—JOHN MACOUN, Ottawa.

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CONCHOLOGY.

LIMNÆA STAGNALIS.—A beautiful living albino of this species was found in Chilcott's Lake, Masham, in August. The animal did not appear to differ from those in the numerous other specimens of the same species which occurred in the same locality; the shell, however, was as white as a pearl and of beautiful lustre. Erosion of the epidermis and exposure to the sun tend to whiten the shells of all our snails; but the epidermis of this example is perfect. Its whiteness results no doubt from disease of those peculiar glands whose function it is, in the shell-bearing mullusca, to extract an infinite number of beautiful pigments and deposit them in that combination of variety and regularity at which all have marvelled who have ever observed a cabinet of shells, where

"Not a shell
"But shows some trace in freckle, streak or stain,
"Of His unrivaled pencil."

HELIX DENTIFERA.—This rare shell was taken a few years ago on Mr. Craig's farm near Casselman. It appears to have reached at that point the north-eastern limit of its distribution in Canada. There is a

record of its occurence in Muskoka, but it is probably erroneous. In the immediate vicinity *H. dentifera* has never been found. In the Province of Quebec, it has an extensive range from Montreal as far east at least as the Island of Orleans and southward to Knowlton, in the Eastern Townships, whence it extends into New Hampshire, Vermont and New York. Near the brow of the shaly cliffs of the Island of Orleans, opposite Montmorency Falls, seven fine specimens were taken in an hour in August, 1891. They do not differ from the Casselman shells except in being thinner. The occurence of *H. dentifera* at places so near to each other as Casselman and Montreal, indicates that the shell may be found at intervening points. If the Club would run an excursion to Alexandria next summer, the conchological branch would probably attend in a body.—F. R. Latchford.

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ZOOLOGY.

Salvelinus Oquassa in the Ottawa District.—A beautiful living specimen of what I take to be a male Oquassa or Blue backed Trout, sometimes called the "Rangeley Lake Trout", *Salvelinus Oquassa*, Girard (sp.) can now be seen living in one of the aquaria at the Fisheries Exhibition on O'Connor Street in this city. This specimen, which has been referred to me for identification, was recently obtained by Mr. Vernon C. Nicholson at Lac de Marbre, in the Township of Wakefield, Province of Quebec, who last year noticed the difference between it and *Salvelinus fontinalis*, Mitchell (sp.), the ordinary Brook Trout of the district. He killed at that time several specimens of *S. Oquassa* in the above named lake. In another lake quite close to Lac de Marbre the ordinary Brook Trout abounds; but so far as Mr. Nicholson observed the two species do not occur together.

The specimen has been identified with *S. Oquassa* from external characters only, and its hyoid bone has not been examined, but if correctly determined, the occurrence of this species in the Province of Quebec is of especial interest, as heretofore it has only been recorded from Maine.

According to Jordan & Gilbert, * the hyoid bone in *S. Oquassa*

* Synops. Fishes N. America. Smithson. Miscell. Coll., vol. xxiv (1883), p. 318.

has a "narrow, median band of teeth," which, however, are "sometimes lost," but in the common Brook Trout (*Salvelinus fontinalis*) the hyoid teeth are wanting. The following is a copy of Jordan & Gilbert's specific description of *S. Oquassa* :

"Body elongate, considerably compressed, less elevated than in the other species of this genus, the dorsal outline regularly but not strongly curved. Head quite small, the maxillary short and moderately broad, scarcely extending to the posterior margin of the eye. Eye large, 3½ in head. Jaws about equal. Scales small, those along the lateral line somewhat enlarged. Pectoral and ventral fins not elongate; opercles without concentric striæ. Coloration dark blue, the red spots small and round, much smaller than the pupil, usually confined to the sides of the body ; sides with traces of dark bars ; lower fins variegated, as in *S. fontinalis*. Head, 5 ; depth, 5. D. 10 ; A. 9. Lat. l. 230 ; gillrakers about 6 + 11. Length, 12 inches. Smallest and handsomest of our trout, as yet known only from the Rangeley Lakes in Western Maine."—J. F. Whiteaves.

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EDITORIAL NOTES.

Winter Soirees.—The first meeting of the Winter Course will be held early in December in the Normal School Lecture Room when Dr. George M. Dawson, C.M.G., F.R.S., &c., will deliver his Presidential address. The full programme for the Course of Winter lectures will be given in our December issue.

Creating a Stir.—A great coming event is the publication of a wonderful almanac to be called the *Star* Almanac, published by the Montreal *Star*, It is said to be a marvellous work, four hundred pages, with coloured maps.

Toronto "Saturday Night's" Xmas Number, 1892.—Another literary treat is promised in the Christmas number of *Saturday Night. The Newsdealer, Publisher and Stationer's Bulletin*, the Canadian correspondent of which has seen advance copies of all that is promised, says that "It will doubtless be the most beautiful publication ever a tempted in America and compares more than favourably with *Figaro* and the most expensive Old Country Christmas numbers."

BOOK NOTICES.

CATALOGUE OF CANADIAN PLANTS. PART VI, MUSCI, pp. 295. By JOHN MACOUN, M.A., F.L.S., F.R.S.C., Montreal, 1892.

In the preceding parts, I. to V., of this very valuable work Prof. Macoun has enumerated the various species and varieties of flowering plants, ferns, and fern-allies, native and alien, to be found within the Dominion of Canada and Newfoundland, and has given very fully the geographical distribution of each so far as this is known. The total number of flowering plants, ferns and fern-allies therein recorded being 3,209 species with numerous varieties. Of these 2,340 are Exogens, 771 are Endogens and 98 are Acrogens, added to which is a list of 165 Hepaticæ or scale mosses. The part under review which treats of the Musci or real Mosses is a phenomenal work, one that has probably never been excelled. The commencement of this great undertaking more than a quarter of a century ago, must have been surrounded with difficulties that could only be overcome by great courage and determination. Still, the author has persevered and after 31 years of unremitting labour he is able to present to the scientific world a record of which he and his fellow countrymen have a right to feel proud. To go into minuter details of so voluminous a work would require more space than can be allowed, so that a mere summary can be given. In the present part, Prof. Macoun records 1,070 species and varieties as the total Moss Flora of Canada, so far as this is at present known, giving a much larger record for Canada alone than is given by Lesquereux and James in their valuable "Manual of the Mosses of North America," which included not only the United States, but also Canada; their record being 1,020 species and varieties. But of the 1,070 species and varieties given by Prof. Macoun, 400 are not recorded in "The Manual," so that the author has raised the Moss Flora of America from 1,020 to over 1,420 species and varieties. And what is even more remarkable is this, that of the 400 additional moss plants 200 are new to science,—have never before been recorded,—hence it may be said with truth that Professor Macoun's work has created an epoch in the Bryology of North America. But what stamps this work with even

greater value, is this, that Prof. Macoun has not depended, for the determination of his plants, on his own unaided judgment, but has submitted them for confirmation to some of our greatest bryological specialists, such as Profs. Lesquereux and James, Mr. Coe. E. Austin, and Drs. Kindberg, Carl Mueller, Venturi and Warnstoff, thus making assurance more assured. Increased value is given to the work by the full and able descriptions of the new species, and by the many personal notes of the author on those little points of difference that indicate close observation and which are so very helpful to the student. The author is to be congratulated on the thoroughness of his work. The work he had set himself to do was expressed in the first sentence of the preface to Part I. : " The purpose of this work is to place in the hands of Canadian botanists, in a connected form, the knowledge so far obtained, of the extent and distribution of the Flora of Canada." This has been carried out even beyond the author's first expectation, and he has presented to the botanists, not only of Canada, but of the world, a work that will command their respect and admiration, a work that must form the basis of all future floras of Canada, and the author will be esteemed as one who did his work ably and well, carrying out to the fullest the Preacher's precept, "Whatsoever thy hand findeth to do, do it with thy might."

J. E. BAGNALL,
A. L. S.

A Text-book of Agricultural Entomology, by Eleanor A. Ormerod, F. R. Met. Soc., &c. Small 8vo, pp. 238. Second Edition, London, 1892.

We have much pleasure in announcing the publication, under the above title, of a new and much enlarged edition of Miss Ormerod's Guide to Methods of Insect Life and Means of Prevention of Insect Ravage. During the last decade, owing almost entirely to the efforts of our eminent and highly esteemed corresponding member, the authoress of this work, Economic Entomology has become recognized in England as an important branch of practical agriculture and is now one of the subjects of agricultural instruction, which is being brought

prominently forward under the arrangements of the new County Councils. The above named treatise has been called forth by the demand for a reliable text-book, and it is well that the preparation of a work, the importance of which will year by year become more evident, should have been taken up by such able hands. The text-book is practically a new work and provides the English cultivator and agricultural student with a concise book of reference by means of which he can identify any injurious insect or its attack, which is likely to occur on his crops. We think that too high praise cannot be expressed for the manner Miss Ormerod has fulfilled her self-imposed task. The language is so simple and concise; and yet each detail is so scientifically accurate, that the danger of making mistakes in the identifications seems quite impossible. Miss Ormerod, from her long experience, perseverance, keen observation, and natural aptitude for this special work, has made herself the highest authority on Economic Entomology in Europe; in fact, she holds among the Entomologists of the old world, the same relative place as Prof. C. V. Riley on this continent. Miss Ormerod does not profess to be what is called a scientific entomologist, but we claim that she is scientific in the truest sense, in that she shows in all her writings a determination to have perfect accuracy before everything else; she spares no trouble to attain that end, and her one object is manifestly to discover as soon as possible the complete life-history of any pest she may have under consideration and the most efficient and practical means of checking its injuries to farmers or others.

CASTOROLOGIA, or the History and Traditions of the Canadian Beaver; by Horace T. Martin, F. Z. S., etc., Royal 8vo, pp. 238. Montreal 1892.

The above work has been received, and it certainly is what it professes on its title page to be, "an exhaustive monograph, popularly written." The author must have spent much time in the collection of the numerous facts which he now gives to the public in this most attractive work. It would be hard to find any subject connected with Beaver lore or with the natural history of the animal, which has been omitted. The illustrations, which are profuse and for the most part

from the pencil of the author himself, are excellent. The printing and general make up of the book are very noticeable. One great defect, however, exists:—there is no Index. Other defects, to the editor's mind, are that, in accordance with a prevailing fashion, the paragraphs are too widely leaded, the leaves are not cut and the paper is left uneven at the edges. Although many approve of these latter features, the first certainly breaks the continuity of the subject, and the second makes it difficult to turn the leaves easily for reference.

The very important role that the trade in Beaver-skins has played in the history of Canada is carefully worked out as well as the uses of the Beaver in manufactures. Of greatest interest to the naturalist is of course the life-history of this animal, in which its habits and methods of constructing its wonderful huts, dams and canals, are fully described and the many fabulous statements of travellers and hunters are discussed. The difference between the European Beaver and the Canadian species, first noticed by Cuvier, is pointed out, and the name *Canadensis* for the North American species, which was given to it by Kuhl in 1820, is claimed to be the correct designation.

In treating of allied animals of the same order, we are pleased to notice that Mr. Martin uses the name Musk Beaver, for *Fiber Zibethicus* instead of the more usual, but less accurate term Musk-rat.

The following titles of some of the chapters give some idea of the scope of this very interesting and instructive work:—Mythology and Folk-lore; The more important American Rodents; Life-history; Geographical Distribution; Engineering accomplishments; Importance in Trade and Commerce; Hunting the Beaver; The Beaver in Heraldry.

Under Experiments and Domestication, a full account is given of the Marquis of Bute's effort to establish a colony of Canadian Beavers near Rothesay in Scotland. The author paid a visit to the "enclosure" in July 1889 and made some interesting observations, which he records.

As appendices are given photo-copies of parts of original documents (1721-1726), Samuel Hearne's account of the Beaver, and a description by Dr. Riley of the remarkable beetle parasitic on the Beaver, *Platypsyllus castoris.*

We have much pleasure in recommending this book to our readers.

CLOTHES MOTHS.

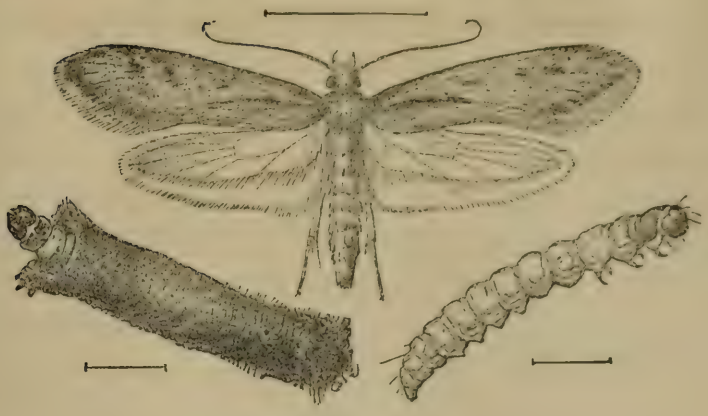
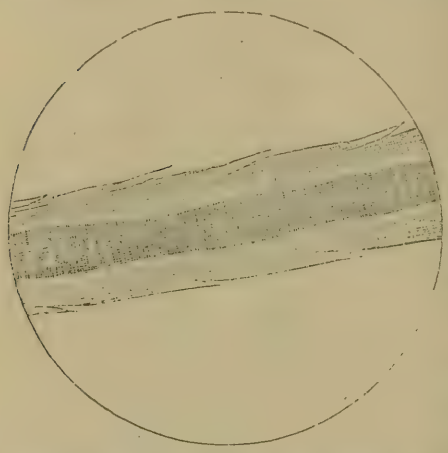


FIG. 1.—Clothes Moth, *Tinea pellionella, L.*

A most remarkable specimen, due to the work of insects, has been sent to the Editor by Miss Lucy C. Eaton, of Truro, Nova Scotia. This consists of a piece of cotton ticking, which had been used for a pillow case, and the inside of which has been so completely covered with fragments of feathers as to have the appearance of gray velvet or plush. Without examining it under the microscope, it seems difficult to believe that the beautifully even surface can have been produced in the way described, but this is undoubtedly the case. Miss Eaton writes that the pillow was made in the fall of 1889, and not opened till two years afterwards. It was filled with turkey feathers, which are very soft and downy at the base. Miss Eaton noticed that when this pillow was placed on beds, although no one made any remarks, she more often than not found it on the floor in the morning. After a time, suspecting nothing, she put it on her own bed, when the mystery was solved, for she says "I could not sleep for the noise like something crawling slowly back and forth." She turned it over and over, but it was no use, she was at last obliged to serve it as it had been served on so many previous occasions, and once more it was thrown to the floor. Some months after, upon opening the pillow, the whole inner surface was found to be entirely covered with a coating of velvety pile, and the feathers, some specimens of which were forwarded, were entirely stripped of down, which was cut into morsels almost as fine as dust. From the extent of

the damage Miss Eaton expected to find an insect of the size of a grasshopper; but found instead only the empty cocoons of the caterpillars of the small Clothes Moth (*Tinea pellionella*, Linn.) shown admirably in the excellent cut (Fig. 1) which has been kindly lent by Dr. C. V. Riley, the U. S. Entomologist. The felting of the ticking was due to the barbed nature of the morsels of feather. The plumules of feathers and the down of many animals when highly magnified are found to be invested with minute barbs, all pointing the same way. The feathers were cut up by the caterpillars of the moths feeding upon them, and the minute barbed portions of the feathers by the movement and shaking of the pillow were brought in contact with the pillow case. These morsels, if short enough, had sufficient rigidity to work their way into the cotton cloth, and were at once fastened there by their own barbs. The value of these barbs in the making of felt is explained in a most interesting manner in Mr. Horace T. Martin's excellent work "Castorologia," where he describes the manufacture of felt from "beaver wool," for the shapes of hats, and shows the nature of the barbs or "staple" of this wool by the magnified illustration (Fig. 2), which he has been kind enough to lend us. In this illustration, a hair of beaver wool is shown magnified 250 diameters.



Beaver fur. Magnified 250 diameters. From Martin's CASTOROLOGIA, p. 132.

The Clothes Moth *Tinea pellionella*, as well as the other two species of Clothes Moths found in this country, *Tinea tapetzella* with black and white wings, and *Tineola biselliella*, with pale, silvery, fawn-coloured wings, is an immigrant from the old world.

1. *Tinea pellionella*, Linn., in the perfect state, is a small, gray moth, with three or four black spots on the wings. These lie flat over the back. The caterpillar lives in a short, muff-shaped case, which it carries about with it. (Fig. 1).

2. *Tinea tapetzella*, Linn. The moth has the base of the wings black and the tips white or gray. The caterpillar lives always in a tube which it spins through and over the article it is destroying, working into it particles of the cloth or other material attacked.

3. *Tineola biselliella*, Hum. The moth is silvery fawn-coloured with the wings sloping when at rest, The caterpillars pins only a sligh tube or path of silk on its food or is frequently found uncovered When full grown it spins a close cocoon something like the case of No. 1, but rounder at the ends and less regular.

These all pass the winter as caterpillars without feeding and change to chrysalides and a little later to moths in the spring.

No article, however short, upon these troublesome insects would be complete without some suggestions as to the best means of preventing their injuries. The whole damage is done by the caterpillars and none by the perfect moths.

The habits are as follows: The moths which lay the eggs from which the caterpillars hatch, appear in spring and through the summer. These fly to any object composed of suitable food for their young to feed upon, and lay eggs which hatch into minute caterpillars; these feed till winter and then remain torpid through the winter changing to moths the followiug spring. When possible all articles of clothing liable to attack should be well shaken, brushed and put away in tightly closed paper parcels before the moths appear in spring. The caterpillars only feed on animal substances, therefore articles wrapped in paper, cotton or linen are safe. Clothes which are not packed away before the moths show themselves should be hung in a conspicuous place where they will not be forgotten so that they may be frequently shaken or brushed.

Carpets, furniture, or furs which have become infested may be sprinkled or saturated with benzine or gasoline which will destroy all insect life. Care must, of course, be taken not to have a light near when these inflammable substances are being used.

Putting camphor, naphthaline, pepper and cedar amongst clothes, have the effect of keeping the moths from laying their eggs upon them to a large extent, but they are not sure remedies.—J.F.

THE WINTER HOME OF THE BARREN GROUND CARIBOU.

By J. B. Tyrrell, M.A., F.G.S., F.G.S.A.

Among the few large animals still found in great numbers on this continent, the Barren-ground Caribou (*Rangifer Grœnlandicus, Linn.*) is probably the most interesting and important. It is the principal occupant of the great lonely wastes that extend southward from the shores of the Arctic Sea, not only in America but also in Europe and Asia. The Indians who people the northern part of Canada, including the Chipewyans, Yellow-knives and Dog-ribs, subsist very largely on its flesh, while its light warm skin with its thick covering of light grey hair furnishes them with beds and winter clothing, and the tanned hides, sewed with the sinews from the back, supply them with footgear and comfortable tents. In fact all their necessities, except their ammunition, tea and tobacco and, a small amount of summer clothing, are supplied by the Caribou.

In size the Barren ground Caribou is much smaller than the woodland species, an adult female shot by the writer near Lake Athabasca being about as large as the common Virginia deer of this vicinity, and weighing about one hundred and fifty pounds; while an adult male of the woodland species, obtained in the rocky country east of Lake Winnipeg, the head of which is now in the Museum of the Geological Survey, weighed between three and four hundred pounds.

The horns are very large and irregular, very few of them being alike, and all being apparently unsuited to travel through the thick woods. The males are said to shed their horns in November, while the females retain theirs throughout the winter and shed them early in the following spring.

Their winter coat of long hair is shed early in July, and by August or the beginning of September the hide is in excellent condition, and the hair is soft and not too long, so that at this season the Indians endeavour to kill a sufficient number to furnish themselves with clothing for the winter. Later in the year the hair becomes harder and more brittle, and the hide is said to be riddled with holes made by the larvæ of a bot fly.

In summer these deer live on the great rocky wilderness that extends from a short distance north of Athabasca and Reindeer Lakes, between Great Slave Lake and Hudson's Bay, to the Arctic Ocean. In the autumn they collect together in large bands and move southwards into the wooded country where they spend the winter, leaving again for the Barrens in the early spring.

During the present year the writer spent the summer in one of their favourite wintering grounds in the hitherto unexplored region north of Churchill River and south-east of Lake Athabasca. Almost all of the deer were at the time away to the north, but a few stragglers had remained behind.

Our party entered the country by ascending the Caribou River, a stream about as large as the Rideau, flowing into Churchill River 225 miles north of Battleford. On the first of July it was found to be at its extreme high water level. Its banks were overhung with willows, and its bed was quicksand, so that we could neither track nor pole, but were obliged to ascend it with the paddle against a heavy and constant current. The river flows in a wide valley, with high granite ridges at some distance back on both sides.

As the river is ascended, poplar, white spruce, and all underbrush gradually disappear, and the country becomes generally wooded with Banksian Pine, with Black Spruce in the wet places, and great stony tracts devoid of timber of any kind. We have now reached the winter home of the Caribou which in this region stretches northward from about Lat 56° 45′. It consists of long almost bare hills of Archæan rocks, separated by wide valleys, the bottoms of which are filled with sand and ridges of boulders. In these valleys lie many small lakes, on the shore of one of which, near the head of Caribou River, the Hudson's Bay Company established a small trading post last autumn, and traded with the Indians throughout the winter, but in spite of the fact that meat is abundant the Indians are not going back there this winter and the post has been abandoned.

The Indians report that the deer collect on the frozen surface of these lakes during the day in immense herds, and are readily killed as long as the desire remains to shoot them, or till the whole herd is

exterminated. My informants stated that last winter the hunters killed from one to three hundred deer apiece. Besides deer a fairly succesful hunt of fur-bearing animals was also made.

This region, so full of magnificent game every winter, is very easily accessible, and a party of hunters could spend a few weeks among the deer without the least discomfort and at the same time have glorious sport. The railroad runs to Prince Albert and from there the winter home of the Caribou is only 250 miles in a straight line, a distance that could readily be covered in a week with dogs, and three forts of the Hudson's Bay Company would furnish stopping places on the route—Isle à la Crosse, the most northerly of the three, is the home of Mr. H. G. Moberly, the officer in charge of the whole district, and a keener sportsman, a pleasanter host, and a more genial companion cannot be found in the west.

Farther to the north, at Fond du Lac, near the east end of Lake Athabasca, a venerable old half-breed named José Mercredi, a native of Red River, has kept one of the Trading Posts of the Hudson's Bay Company for the past forty-seven years, supplying a band of about 80 Chipewyans with ammunition, tea, tobacco and the few other products of civilization which they require, receiving in return a large amount of Caribou meat, in the form of dried meat and pemican, which is sent to assist in supporting the people at Fort Chipewyan and other less favoured posts on Athabasca and Slave Rivers. Fond du Lac itself is situated at a narrow part of the lake on one of the main paths used by the Caribou southward, and Mercredi informed me that for a week or more in the autumn the deer can be killed in great numbers from the door of the Post as they pass through the yard and among the houses. Several of the men were said to have killed as many as four hundred during the past year.

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OVIS CANADENSIS DALLI, *Nelson.*

By R. G. McConnell.

While crossing the Rocky Mountains, in 1888, from Fort Macpherson on Peel River to Lapierre House on the Porcupine, Lat. 67° 40′ N., the writer was fortunate enough to come across the interesting

variety of the Mountain Sheep known as *Ovis Canadensis Dalli*, Nelson. The specimen seen was shot on a steep rocky slope near the summit of the range, and in rolling down, the skin and horns were injured so severely as to render them useless as specimens. This variety of the Mountain Sheep differs from the type of the species in its smaller size, in its uniform white colour, and in the slenderer build of the horns, but all these characters appear to be variable. The first information in regard to this animal is given in a short article by Mr E. W. Nelson in the proceedings of the U. S. National Museum, Vol. VII., p. 12, 1884. (See also Report upon Natural History collections made in Alaska between the years 1877 and 1881 by Edward W. Nelson, p. 282, issued in connection with the Signal Service U. S. Army, 1887. Mr. Nelson in this article describes the colour as a dingy white and states that the hairs are tipped with a speck of rusty colour. Lieut. H. T. Allen, U.S.A., on the other hand in a letter in "Science," Vol. VII., p. 57, 1886, states that the sheep seen by him on the head waters of Copper River, Alaska, were by no means dingy, but were, in fact nearly as white as their surroundings of snow. The latter statement agrees with my own observation, as the animal shot by my Indians was almost pure white. Another variation in colour was reported to me by some miners on the Yukon, who described some sheep shot by them on the upper part of this river as having a brown patch on both sides behind the fore shoulders, and referred to them as the "Saddle-backed Sheep." The latter probably mark a stage in a progressive change in coloration from the nearly uniform dull-brown of the normal species to the pure white of the northern variety.

The diminution in size of the northern sheep is even more remarkable than the change in coloration. Those shot in the southern part of the Canadian Rockies range in weight up to three hundred pounds, while the sheep brought into Fort Macpherson from the mountains west of Red River, according to Mr. Hodgson the officer in charge of that post, seldom exceed a hundred pounds in weight. Some of the specimens seen by Lieut. Allen, U.S.A., on the high snowy mountains at the head of Copper River, Alaska, are described by him as being as large as the ordinary Big-horn, while others met with only a

short distance away and at a lower elevation were very much smaller. It would appear from this that the decrease in size towards the north is not constant and cannot be altogether dependent on climatic conditions.

The light-coloured variety of the Mountain Sheep ranges along the Rocky Mountains from the Arctic Ocean southward, so I am informed, to the great break in the chain through which the Liard flows (Lat. 59° 30′ N.). It is also found on all the higher mountain ranges of Alaska and the adjacent part of the North-Western Territory of Canada. It is not found east of the Rocky Mountains nor does it occur, according to the information I obtained from fur traders and others, in the continuation of the Rocky Mountains south of the Liard.

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NATURAL SCIENCE IN ILLINOIS.

The opening of the Natural History Hall of the University of Illinois, at Champaign, Ill, on 16th November last, shows the high appreciation of Economic Science in the Western States, where the "making of money" is supposed to be the sole consideration of all classes of society.

The building and equipment of such an Institution as is described below, proves that if even the most abstruse scientific investigations can only be shown to be of public utility, the necessary money will bo forthcoming for their prosecution. This Natural History Hall may be considered to be a monument to Prof. S. A. Forbes, the eminent State Entomologist of Illinois, to whose unceasing and well directed efforts its completion is so largely due. Prof. Forbes is too well known as an accomplished investigator in various fields of Natural History, to make a detailed notice of his work necessary here. He was appointed to his present position in 1882, and, in addition to his official reports as State Entomologist, has issued many valuable papers in scientific publications. His studies of the food habits of birds and fishes are of the highest merit. He is now engaged in the preparation of the second volume of the Ornithology of Illinois. Part I, already issued, is a Descriptive Catalogue (520 pages, 33 plates), by Dr. Robert Ridgway; Part II, Economic Ornithology, will be the work of Prof. Forbes. These volumes are the first of a series on the Zoology and Cryptogamic Botany

of the State of Illinois, authorized and provided for by the Legislature in 1885, and will be prepared under the direction of the Illinois State Laboratory of Natural History.

In the autumn of 1890, the Editor had an opportunlty of visiting Champaign, and was kindly shown over the entomological and botanical laboratories by Professors Forbes and Burrill, and is therefore able to form some idea of the excellent methods of work adopted at the University of Illinois, in the branches of research over which these gentlemen preside.

Having no doubt that some account of this splendid addition to the facilities for the prosecution of good natural history work in North America would be of interest to our readers, the editor wrote to Prof. Forbes, asking him to give some data concerning the Institution itself, and the dedicatory ceremonies. In reply to this request the following letter was received :

CHAMPAIGN, ILLINOIS, U.S.A., November 18th, 1892.

Your kind note and the copy of the "OTTAWA NATURALIST" were duly received and especially appreciated. I am pleased that you thought of making some mention of our new building, and take pleasure in giving you such particulars as it seems to me you are most likely to want to use.

The building was put up at an expense of $70,000, exclusive of furnishing, appropriated by the State Legislature. It is 134 feet in length by 94 in width, and three stories in height above the basement. There is a spacious, well-lighted central hall, around which on all sides are situated laboratories, lecture rooms, closets, store rooms, and dark rooms, a full series for each department.

As an example of the arrangement and equipment of this building a general description may be given of the provision for zoology. The students' laboratories in this department are three in number on the first floor—for elementary, advanced, and postgraduate work respectively. In the first, table room is given for thirty students: in the second, for sixteen ; and in the last, for ten. Adjoining the first is the private laboratory of the Assistant in Zoology, and next this the lecture room. Directly over the Assistant's laboratory is that of the Professor

of Zoology, and over the postgraduate laboratory is his private office. On this second floor are also the rooms of the State Laboratory of Natural History, consisting of an assistant's laboratory 21 x 36 feet, a collection room of the same size, a library 23 x 32, and a room for the artist of the establishment. In the basement of the building is a very large store room for the department, and an animal room to be fitted with aquaria, animal cages, and the like.

The zoological laboratories are furnished with an abundance of microscopes, and with microscopic apparatus, including first-class microtomes, an incubator, and an imbedding apparatus. A full equipment for field work in the various departments is at the service of the students, and the library and collections of the State Entomologist and the State Laboratory of Natural History are also made accessible to them under suitable restrictions.

On the third floor are the zoological collection rooms, containing the material required to illustrate the work of the department.

Intimately associated with the zoological deparment of the University, and practically merged with it since 1884, is the work of the Illinois State Laboratory of Natural History and that of the office of the State Entomologist of Illinois; the former consisting essentially of a systematic and thorough-going investigation of the zoology and cryptogamic botany of the State, the results of which are in process of publication by the legislature, and the latter of entomological investigations whose main end is economic, but whose product is largely scientific and educational. Both these departments of work, although supported by appropriations independent of those of the University, are directed by the head of the zoological department of University instruction, and provided with quarters and facilities in Natural History Hall.

Our dedicatory exercises were completely successful. Dr Jordan did us the very great kindness to come all the way from California for the express purpose of deliverieg the principal address, and Professors Trelease and Winchell also contributed very interesting papers. There was a considerable attendance of scientific men of this and adjoining States, and others would have been here had we been able to announce

our programme earlier. The dedicatory exercises proper were followed in the evening by a lecture by Dr. Jordan on "Agassiz and his Influence," and a Faculty reception to the invited guests.

The addresses and some accompanying papers will be published as soon as practicable, for general distribution, in a small illustrated book.

Sincerely yours,

S. A. FORBES.

The following is a list of some of the papers read on the above occasion :—

"Development of the Natural History Departments"—Prof. T. J. Burrill.

"Science and the American College"—Dr. D. S. Jordan.

"The Laboratory as a necessary part of the College equipment"—Prof. Wm. Trelease.

"The methods of Geology"—Prof. N. H. Winchell.

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BOOK NOTICES.

1. Grasses of the Pacific Slope, including Alaska and the adjacent Islands. Part I. By Dr. George Vasey.

The above volume, consisting of 52 exquisite plates, has just been issued as Bulletin 13 of the United States Division of Botany. In the introduction, Dr. Vasey says: "The grasses which are known to grow on the Pacific slope of the United States, including Alaska, number not far from 200 species. These are all specifically distinct from the grasses growing east of the Mississippi River, and also mainly distinct from the grasses of the plains and of the desert, except in that part of California which partakes of the desert flora. A considerable number of the grasses of the mountain regions of California, Oregon and Washington reappear in the mountains of Idaho, Montana, and the interior of the Rockies." In this Bulletin are figured for the first time, and described, several grasses conspicuous in size and apparent utility. This fact gives the work great value, not only to botanists, but also to the large number in the west, now interested in the raising of domestic animals.

It is of special value to Canadian botanists, from the comparatively large number of rare and little known species figured, which are mentioned in Professor Macoun's Catalogue; but which very few besides the Macoún's, father and son, have ever seen.

The following is a list of the species mentioned in Prof. Macoun's Catalogue which are figured in the present work :—

Agrostis æquivalvis, *Trin.*	Macoun's Cat.	No. 2778	(Deyeuxia.)
" humilis, *Vasey*	"	" 3204	
Alopecurus alpinus, *Smith*	"	" 2729	
" geniculatus, *L.* *var.* robustus, *Vasey*	"	" 2730	
" Howellii, *Vasey*	"	under 2730	
" Macounii, *Vasey*	"	No. 2731	
" saccatus, *Vasey*	"	under 2730	
Calamagrostis Aleutica, *Trin.*	"	No. 2779	(")
" crassiglumis, *Thurb.*	"	" 2783	(")
" deschampsioides, *Trin.*	"	" 2784	(")
" purpurascens, *R. Br.*	"	" 2791	(")
Deschampsia cæspitosa, *Beauv.* *var.* arctica, *Vasey*	"	" 2804	
Stipa occidentalis, *Bol.*	"	under 2738	
Trisetum canescens, *Buckley*	"	No. 2809	
" cernuum, *Trin.*	"	" 2810	

The descriptions of the species are stated to be almost wholly the work of Assistant Botanist, Prof. L. H. Dewey, and the beautiful figures are drawn chiefly by Messrs. T. Holm, W. R. Scholl and F. Muller.—J. F.

2. The Portland Catalogue of Maine Plants.

Under the auspices of the Portland Society of Natural History, Prof. Geo. L. Goodale, and the late Rev. Joseph Blake, published in 1868 the first edition of a "Catalogue of Maine Plants." The second edition, just out, has been prepared by Mr. Merritt Lyndon Fernald, of Cambridge, Mass., and contains additions to the 'old list,' besides

the results of a careful examination of the herbaria of some twenty botanists of Maine, to whose collections the author had access. This new catalogue is intended to be an introduction to a much more annotated list of plants, which, it is hoped, may be published within a few years. The plants of Maine, and those of the Maritime Provinces and adjoining portions of the Province of Quebec, are very similar, and a careful comparison between the records obtained in these sections of North Eastern America, will soon reveal the vast amount of work—good work—that has been and is being done; also of the geographical distribution of certain forms in various conditions, such as these Atlantic provinces afford.

The Portland Society of Natural History deserves commendation for the neat and careful way in which the Catalogue has been published.

H. M. Ami.

ORNITHOLOGY.

Edited by A. G. Kingston.

A fine specimen of the White-headed Eagle (*Haliœetus leucocephalus*) was shot by Mr. Edward White about the middle of November in a marsh near Rockland, about twenty miles east of the city. It was a young male, and measured 6 feet 9 inches across the extended wings. This bird is becoming exceedingly rare in the settled parts of Canada.

A curious instance of aberration from the usual nesting habit in the Chimney Swift (*Chætura pelagica*) came under the writer's observation in October last at Aylmer, Elgin Co., Ont. Instead of the seclusion of a hollow tree or disused chimney, the birds had chosen in this case to establish their home in a small outbuilding near the railway station. Despite the fact that persons were frequently passing through the building, the little cup of twigs had been glued against the wall about five feet from the floor. The marks of attachment and a few broken twigs still adhered to the wall when found, but the greater part of the nest had been torn down and laid upon a shelf close by.—A. G. K.

GEOLOGICAL SOCIETY OF AMERICA.

In response to an invitation from the Royal Society of Canada and the Logan Club, the Fifth Annual Meeting of the Geological

Society of America will this year be held in the City of Ottawa, beginning on Wednesday, December 28th, and lasting for three days.

Through the kindness of Dr. John G. Bourinot, C.M.G., the President of the Royal Society of Canada, the general meetings will be held in the Committee Rooms of the House of Commons. Addresses of welcome will be presented to the visitors by His Excellency the Governor General of Canada, and by the President of the Royal Society. It is also expected that a Popular Lecture, illustrated by lime light, will be given on the evening of the first day, and for this purpose Dr. MacCabe has kindly placed at the disposal of the Society, the large new Lecture Hall of the Normal School.

It is understood that all the meetings will be open to the public, aud there is no doubt that many valuable and interesting papers will be submitted.

Prof. G. K Gilbert, of the Geological Survey, Washington, is President of the Geological Society of America, and Prof. H. L. Fairchild, of Rochester, N.Y., is Secretary, both of whom will be present, and there are in Ottawa no less than 16 members of the staff of the Geological Survey Department, who are also members of the Society.

The programme is not yet completed, but the titles of several excellent papers have already been sent in, and doubtless many more will yet be received.

The annual Dinner of the Society will be held, conjointly with that of the Logan Club, on the evening of December 29th, at the Russell House, which will be the headquarters of the Society during their visit.

Among other papers to be read, the following are by Ottawa members :—

"The Coals and Petroleums of the Crow's Nest Pass" .... Dr. Selwyn.
"The Devonian of Manitoba and the N. W. Territories"
Mr. J. F. Whiteaves.
"The Laurentian of the Ottawa District" ..... Dr. R. W. Ells.
"Glacial Phenomena of the Athabasca District" .... Mr. J. B. Tyrrell.

"The Archæan of the Sudbury District"... ..... Mr. A. E. Barlow.
"Cambrian Fossils from the Rockies and Selkirks" ..Dr. H. M. Ami.
"On the Relation of the Potsdam and Calciferous....Dr. H. M. Ami.
"Natural Gas and Petroleum in Ontario" .....Mr. H. P. Brumell.
"Glacial Phenomena of the North East Territories"...Mr. A. P. Low.
"Notes on the Geology of the Gold Range".....Mr. J. MacEvoy.
"Notes on the Glacial Geology of the Bay of Fundy". Mr. R. Chalmers.
"Notes on the Geology of Middleton Island, Alaska"
Dr. George M. Dawson.
"Glacial Pot-holes in Canada" .....Dr. Robt. Bell.
"Phosphate bearing Rocks of Quebec" .....E. D. Ingall.
"The Archæan Rocks west of Lake Superior"..Mr. W. H. C. Smith.

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EVENING LECTURES.

The first meeting of the Course of Thursday evening Lectures will take place on Thursday evening, Dec 15th, at 8 o'clock p.m., in the Lecture Room of the Normal School, which has been again placed at the disposal of the Club, through the kindness of Dr. J. A. MacCabe, the Principal.

It will be seen by the programme submitted herewith, that the subjects to be presented are of particular interest.

The usual course of Monday Afternoon Popular Lectures will not be given this season, owing to the large number of similar classes and lectures, which, for the present, render the course unnecessary. Owing to the unavoidable absence of the President, Dr. George M. Dawson, who has been summoned to England in connection with the Behring Sea arbitration, the inaugural address will be delivered by the 1st Vice-President, Mr. Frank T. Shutt.

As in the past, all of the soirées will be held in the Lecture Room of the Normal School, and will begin punctually at 8 p.m. They will last about an hour and a quarter. The Council is anxious to have it made known as widely as possible that admission to all these instructive lectures is FREE. Anyone wishing to attend may always be sure of a hearty welcome.

PROGRAMME

1892—Ottawa Field-Naturalists' Club—1893.

EVENING LECTURES, 8 P.M.

1892.

Dec. 15—Address of Welcome.....Dr. J. A. MacCabe, M.A.

Inaugural Address: "The Air of our Houses"—

Mr. F. T. Shutt, M.A., F.I.C., F.C.S.

1893.

Jan. 5 —"The Fauna and the Flora of the Selkirk Summits"—

Prof. John Macoun, M.A., F.L.S., F.R.S.C.

"The Mineral Waters of Canada"..Mr. H. Peareth Brumell.

Report of the Botanical Branch.

Jan. 19—"Food in Health and Disease".....Dr. L. C. Prévost.

Reports of the Entomological and Ornithological branches.

Feb. 2—"Narrative of a Journey in 1890 from Great Slave Lake to Beechy Lake, on the Great Fish River." From the Journal of Mr. James McKinley, officer in charge at Fort Resolution, H. B. Co.....Mr. D. B. Dowling, B.A. Sc.

"The Chemistry of Soils".....Mr. A. Lehmann, B.S.A.

Report of the Conchological Branch.

Feb. 16—"The Development of Varieties, and the Multiplication of Individuals in Horticulture".....Mr. John Craig.

"Notes on Rainy Lake District"..Mr. W. H. C. Smith, C.E.

Report of the Geological Branch.

Mch. 2—"The Progress of Metallurgy in Canada"—

Mr. N. J. Giroux, C.E., F.G.S.A.

"My Aquarium".....Mr. H. B. Small.

Report of the Zoological Branch.

EVENING LECTURES, 1892-93.

First meeting held Dec. 15th, 1892. Mr. Frank T. Shutt, M.A., Vice-President, in the Chair.

There were two papers on the programme: An Address of Welcome by Dr. MacCabe, Principal of the Normal School, and the Inaugural Address, by Mr. Shutt.

The chairman, in introducing Dr. MacCabe, said: I have great pleasure in announcing that we have with us this evening, the gentleman through whose kindly offices the Field-Naturalists' Club has the gratuitous use of this Hall in which to hold their winter meetings,—Dr. MacCabe, Principal of the Normal School.

We owe him a great debt of gratitude for this privilege; for looked at merely from a monetary standpoint, this arrangement effects a considerable saving in the Club's funds. But this, I take it, is by no means the only, nor indeed the greatest, advantage in our meeting here. By so doing, the work of the Club is brought very prominently and forcibly before that large class of workers—the Normal School students—men and women who are here for a time, for the purpose of fitting themselves for the grand profession of teaching. May we not hope, nay rather may we not expect, that the attendance here, and on our field days, may have awakened in many, a love and an interest for Natural Science, in the animals, the plants and the rocks that are about us; and may we not further expect that they, in turn, will impart to their pupils the knowledge here gained—that love and interest in the things of nature that we have been the means of instilling. Thus it is, that through them the work and influence of the Club may be extended into fields otherwise impossible for us to occupy.

Upon the invitation of the Council, Dr. MacCabe has kindly consented to address a few words of welcome to the Club.

Dr. MacCabe, on coming forward, was warmly greeted. The following is an abstract of his address, which was listened to with great attention and pleasure. The points introduced were apt and strongly put. Dr. MacCabe is a dignified and easy speaker, and his distinct enunciation made it easy for everyone to hear what he said:

Dr. MacCabe said he had much pleasure in renewing the welcome

he extended to the Club and its friends on the occasion of its first meeting in the Normal School. The Club is welcome for two reasons :— First, because its work is part and parcel of the great work of aducation, to which this institution is dedicated ; secondly, because of the fact that many members of the staffs of the Normal and Model Schools, are active members of the Club ; and the Normal School students—to their profit and pleasure—are made welcome to the lectures and excursions.

The Ottawa Field-Naturalists' Club is one of those working bodies of Scientists, who in the language of Shakespeare, find "tongues in trees, books in the running brooks, sermons in stones, and good in everything."

The study of natural science when prosecuted aright, cannot fail to be productive of immense benefit during all the future career of the student. It communicates knowledge of great practical value in almost every sphere and pursuit of life. It has been well said :—"It will not be difficult to show that almost every new and valuable invention, from the spinning-jenny to the telephone, which has increased the control of man over nature, economised his time, or added to his comfort, is the product of scientific knowledge, and often of experiments and researches which had, at first, no merely utilitarian purpose, but were undertaken with the sole and simple object of discovering the secrets of nature, and of revealing truth. And there is not a single lesson by means of which you can convey to a learner a strong interest in any one department of physical science, which may not develop itself, as it works and germinates in his mind, into results and discoveries of unexpected value, and add enormously to the resources and to the enjoyments of mankind.

And, if the study of Natural Science is of inconceivable value in all the practical pursuits of life, it is equally advantageous, in the disciplining of mind. Prof. Huxley, in a lecture on scientific education, puts the matter clearly, thus :—"If scientific training is to yield its most eminent results, it must be practical—that is to say, in explaining to a learner the general phenomena of nature you must, as far as possible, give reality to your teaching, by object lessons. In teaching him

botany, he must handle the plants, and dissect the flowers for himself; in teaching him physics or chemistry, you must not be solicitous to fill him with information but you must be careful that what he learns, he knows of his own knowledge. Do not be satisfied with telling him that a magnet attracts iron; let him feel for himself the pull of the one upon the other. In all other branches of Natural Science, pursue this discipline carefully and conscientiously, and you may be sure that, however scanty may be the measure of the information which you have poured into the learner's mind, you have created an intellectual habit of priceless value in practical life. If you are setting to work to teach science, you must teach it through his eyes, his hands and his other senses."

The work of the Field-Naturalists' Club is, thus, educational in the true sense of the term. The powers of observation are cultivated through the analytical process to which each object is subjected; the tracing of relations, generalization, classification, the formation of principles and laws—all these processes which are among the highest of our mental activities are carried on in this practical work. And the mind will be led from the world of visibilities to that of invisibilities, from matter to mind, from finite to infinite, from Nature to Nature's God.

Dr. MacCabe wished the Club a very successful winter's course of lectures, and at the close of his most interesting address, which was loudly applauded, Mr. Shutt spoke as follows:

Ladies and Gentlemen,

I am sure you are all of one mind with me when I express very sincere regret at the absence of our President to-night. For some months past, not only the members of the Club, but their friends also, have been anticipating the pleasure of listening to his Inaugural Address this evening—a pleasure which, I trust, is not lost but only postponed.

I counted the Club especially fortunate, when at our last annual meeting we prevailed upon Dr. Geo. M. Dawson to accept the Presidency of our Society. We were indeed, fortunate, in securing as our Chief Officer, a man of such high scientific standing; of such eminent ability; of such deep and thorough culture. A man so widely read and so widely travelled, and withal, so genial a gentleman as Dr. Dawson. As most of us are aware, the distinguished honour was con-

ferred upon him some time ago, of being appointed one of the Commissioners in the Behring Sea Arbitration, now pending between us and the United States. It was only three weeks ago, and after he himself had fixed upon this date on which to deliver his opening address, that he informed us that he was suddenly re-called to England in connection with his duties as Commissioner, and that consequently he would be unable to be with us this evening.

I do not pretend to fill his place. I merely, by reason of my office, and at the urgent request of the Council, take precedence on the programme.

Before entering upon the subject of my address, however, you will naturally expect me to say something regarding the growth, the welfare and the present standing of the Club. I propose, therefore, to bring before you very briefly, some of the more important facts and features in the Club's more immediate history. Such information should be of interest both to us, who are members, and to those who are with us for the first time to-night. It is the wish that every member should be a real, active, live member, doing *something* for his or her own educational good, and the furtherance of the interests of us all. Working members ought to know—must know—what the Club is doing and how it prospers, if the work is to be successful.

THE CLUB.

The Club is not composed, as some might imagine, of scientists. We make no such claim. The Club is made up of those who have some love for nature, in one or other of her phases; of those who are wishful to learn something more than they already know regarding animals and plants, and the "solid ground of nature;" of those who, thus learning, are willing to share with and impart to others such fragments of knowledge as they have been fortunate in adding to their store. As Dr. MacCabe rightly said, we are first and foremost, an educational society. Opportunities to learn and investigate are offered to our members, in winter and summer; let us see to it that we take advantage of them.

We have also another feature in our club life. I have been pleased to notice that we are a social Club, and to remark that there exists

between a large number of our members a great and enduring friendship. It is certainly worth recording that there is this feeling of fraternity among those banded together to study nature.

MEMBERSHIP.

Our membership roll now stands at 275, having gained 26 new members during the past year. This, I think, is a very creditable record. The prospects are that we shall still further increase in the near future, as there are unmistakable signs of increased vitality and activity. With much regret I announce the loss by death of four members. Of these, I might mention particularly, the Abbé Provencher, the well known entomologist of Quebec, and Mr. W. P. Lett, our respected citizen, who for so many years contributed towards our winter programmes, papers which were always listened to with great interest.

EXCURSIONS.

I must now refer briefly to our Excursions, which have become such a noted feature of our summer life. We have had three general excursions this year, two of which were to explore the enchanting district lately opened up by the Gatineau River R.R. The natural scenery of the Gatineau Valley, bold and romantic, has been enjoyed by all who accompanied us, Nearly five hundred took advantage of these opportunities to "naturalize," and the unanimous verdict was that these outings were a great success. The third general excursion was held to Casselman, on the Canada Atlantic Railway, but owing to the weather being unpropitious, our attendance was small. The Saturday afternoon sub-excursions to points in the immediate neighborhood continued throughout the summer season.

JOURNAL.

During the past year, the OTTAWA NATURALIST appeared regularly and promptly, month by month. In it have been published many papers of more than passing interest and merit. The volume is one that reflects great credit upon the Club and its editor. For the arduous task of editing we owe our heartiest thanks to Mr. Fletcher, "the father of the Club," who has spared no pains in this, his labour of love, to produce the society journal of which we are deservedly proud.

PROGRAMME,

The programme of the ensuing year is before you. Your Council have been at no little pains to prepare it. I believe it is one worthy of the Club, and I am sure it is one sufficiently varied to prove interesting to all. Our speakers are well known men in science, and they have selected subjects upon which they can speak as those in authority. I would earnestly invite such an attendance at our meetings as will show those who are thus working for us that we appreciate their efforts. I can confidently assure you that a regular attendance will not only give encouragement to those who address us, but also embue the listener, with that interest which results in benefit to themselves, and in the acquirement of much useful knowledge.

In conclusion, allow me to offer you four short rules for the coming year :

1. Attend the meetings regularly.
2. Read the Journal.
3. Go to the Excursions.
4. Pay your membership fee.

These are simple and easy to remember, and if faithfully carried out will make the Club still more successful than it has been in the past.

Mr. Shutt's lecture on Ventilation, entitled "The Air of our Houses," which here followed, will be printed in a future number.

ED. O. N.

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A GREAT ALMAMAC.

The *Star* Almanac of Montreal is just out. It is a splendid thing. Everybody should have it, if they can possibly get it. It is being sent abroad in large numbers.

REPORT OF THE ENTOMOLOGICAL BRANCH FOR THE YEAR 1891.

(*Read February 25th, 1892*).

To the Council of the Ottawa Field-Naturalists' Club.

GENTLEMEN,—The leaders appointed in the section of Entomology have to report that they were not able to devote to their allotted duties, as much time as in former years. The prolongation of the session of Parliament during the collecting season, absence from the city, and other causes made it impossible for them to do as much work as they looked forward to accomplishing.

During the early part of the season very good collections of Hymenoptera were made, including about seventy-five kinds of Sawflies, of which two or three are undescribed species. An interesting outbreak of an imported sawfly was that of *Fenusa varipes*, St. Farg. (= *melanopoda*, Cam.) upon European alders at the Experimental Farm. This insect has become a serious pest and produces two broods during the season; the larvæ mining between the upper and lower surfaces of the leaves, and giving the foliage a very blotched and unsightly appearance. The imported Larch Sawfly (*Nematus Erichsonii*, Hartig.) still commits serious injury to the tamaracs (*Larix Americana*), in the neighbourhood, and the trees over many acres of swamp have already been killed.

A very interesting lot of small Hemiptera, chiefly homoptera, was also collected, which is now in the hands of Mr. Van Duzee for determination, and he writes that the lot contains some choice species. This district seems to yield a large variety of hemiptera, and the list of species already known is quite extensive, although no member has given them the special attention which they deserve.

The collections in Coleoptera were inconsiderable, and added little to our knowledge of this order, although many of the families still require special attention, and a systematic search should be made for species which in all probability occur here, but which have so far been overlooked.

In Lepidoptera the season was particularly unproductive, although as usual a few rare species rewarded the persistent collector. An

expedition to Chelsea in search of *Thecla Niphon* only resulted in the capture of a single specimen, although all the circumstances seemed favourable; the weather was warm and clear and the meadow where it was taken in abundance in 1880 was copiously decked in every direction with the flowers of *Antennaria plantaginifolia*, its favourite plant. Early in the spring the Canker Worm (*Anisopteryx pometaria*) appeared in destructive numbers in some of the apple orchards near the city and also greatly defoliated basswoods, ashes, etc., in the neighbouring country. The Eye-spotted Bud-moth, another pest of the apple, was also exceedingly troublesome, destroying the forming bunches of blossoms, and also boring down into the heart of the fruit spurs. Two other small moths belonging to the *Tortricidæ* also beset the apple trees to a serious degree. These were *Cacœsia rosaceana*, a leaf roller which feeds on various plants besides the apple, and *Lophoderus quadrifasciana*, Fern., a small apple-leaf roller. Experiments were tried for controlling all of these, and it was found that spraying with a weak mixture of Paris Green was the most successful treatment. Locally the Black Army Worm, *Noctua fennica*, appeared in destructive numbers and committed serious injury to crops, particularly peas and clover. A fine specimen of the large and rare moth *Erebus odora* was taken by Mr. Martin Griffin, jr., and presented to the Museum of the Geological Survey. This moth has upon a few occasions been taken in Canada, but it belongs to the West Indian fauna, and it is supposed that the specimens taken in Canada have flown here from the Southern States or the West Indies. *Acronycta funeralis*, a rare and very pretty species, was bred from white birch. The caterpillar is blackish-green, and is marked on each segment along the back with an orange blotch, which bears long flattened hairs of a quill-like consistency. The caterpillar was taken almost full grown in June, and the moth emerged in August.

W. H. Harrington.
James Fletcher.
T. J. Maclaughlin. } *Leaders.*

LIST OF COLEOPTERA.

COLLECTED IN 1883-84 BY MR. T. C. WESTON ON AND IN THE VICINITY OF THE CYPRESS HILLS, N.W.T.

BY W. HAGUE HARRINGTON.

1. Calosoma calidum, *Fab.*
2. " obsoletum, *Say.*
3. " Zimmermanni, *Lec.*
4. Pasimachus punctulatus, *Hald.*
5. Amara obesa, *Say.*
6. " sp.
7. Anisodactylus semipunctatus, *Lec.*
8. Dytiscus dauricus, *Gebl.*
9. Necrophorus tomentosus, *Web.*
10. Silpha Americana, *Linn.*
11. Coccinella monticola, *Muls.*
12. Saprinus lugens, *Er.*
13. Buprestis fasciata, *Fab.*
14. " rusticorum, *Kirby.*
15. Pœcilonota ferrea, *Melsh.*
16. Aphodius occidentalis, *Horn.*
17. " sp.
18. Diplotaxis punctipennis, *Lec.*
19. Tragosoma Harrisii, *Lec.*
20. Criocephalus productus, *Lec.*
21. Monohammus maculosus, *Hald.*
22. " scutellatus, *Say.*
23. Chrysomela elegans, *Oliv.*
24. " multipunctata, *Say.*
25. Upis ceramboides, *Linn.*
26. Asida sordida, *Lec.*
27. Eleodes tricostata, *Say.*
28. " extricata, *Say.*
29. " gentilis, *Lec.*
30. " hispilabris, *Say.*
31. Nemognatha lurida, *Lec.*
32. Epicauta maculata, *Say.*
33. " sericans, *Lec.*
34. Cantharis Nuttalli, *Say.*

ENTOMOLOGY.

EDITED BY W. HAGUE HARRINGTON.

The family Carabidæ contains a large number of species of beetles of predaceous habits, and consequently of importance to mankind in destroyiug the larvæ of obnoxious insects. The beetles are easily found, as they mostly hide during the day under stones or similar shelters, and many of the species are so abundant as to be seen hurrying off whenever any stone or piece of wood is turned over in a field or similar locality. The largest and most conspicuous of the Ottawa species of Carabidæ belong to the genus Calosoma, although they are nearly approached in size by *Harpalus coliginosus*, a large dull-black beetle, which inhabits sandy fields, but is not common.

Calosoma calidum is abundant in fields and gardens, where it does good work in destroying cutworms, and it is readily recognized by the three conspicuous rows of fiery spots, or foveæ, which ornament each elytron. Occasionally a specimen occurs in which the spots are bright green instead of coppery or golden-red, and in the west such coloration is more common. Of a large number received from Rev. G. W. Taylor, of Victoria, about seventy-five per cent. have the green foveæ. This beetle has a wide distribution in Canada, extending from Nova Scotia to Vancouver Island.

The probable occurrence here of the large handsome green *Calosoma scrutator* has been noted in the present volume, and it is hoped that its presence at the capital may be verified. There is, however, a third species which combines some of the features of both the previous beetles, approaching *scrutator* in its shape and slender legs, but in colour resembling *calidum*, and also in the ornamentation of the elytra, except that the rows of foveæ, or punctures, are not so pronounced, and that they are green. This beetle is not often seen and may be classed with our rarer species of ground beetles. On 23rd May, 1883, a specimen was taked under a piece of driftwood on the lower end of Kettle Island, about three miles below the city, and it was several years before another was found, which was an accidental capture in the city on 28th June, 1891. Last year, on the 12th June, in a corner of the Hull beaver-meadow, on the margin of the woods, a large beetle was seen running in the grass, and on capture it proved to be the species in question: *Calosoma frigidum*.

Further search in the vicinity, among the grass and under some loosely-piled stones, resulted in the discovery of three more specimens, and subsequently, during an examination of the adjacent trees, which were almost defoliated by the caterpillars of the canker-worm moths, *Anisopteryx pometaria*, another specimen was found in a tree evidently on a hunt for these larvæ. This local abundance of the beetles was doubtless due to the plentiful supply of food at hand. The caterpillars were continually falling in such numbers that the beetles would not have much occasion to ascend the trees to hunt for them. These devastating caterpillars had been almost equally numerous the previous year, especially upon the ashes which grow in the low moist ground under consideration, and *Calosoma frigidum* had evidently multiplied more than usually, since it had not previously been found in that neighbourhood. Any member desiring specimens of this handsome beetle is advised to search there for them next June. Two specimens of this beetle were also found in the city during the summer.

Some of the species of Calosoma are quite arboreal in their habits, searching aloft the larvæ upon whose succulent bodies they feed, but only on one occasion have I seen our common species *C. calidum* thus engaged.

On page 85 of this volume mention was made of a dipterous larva which feeds on the seeds of the so-called Canada thistle, and of a parasitic Chalcid referred to as a Solenotus. This interesting parasite has been recently re-studied by Mr Ashmead, who finds that it is really a Tetrastichid, and he has described it as *Cratepus Fletcheri* (Can. Ent. Vol. XXIV., p. 309). The only other recognized species of the genus is a European one, also reared from a species of thistle. The fly which thus attacks our thistle heads is widely distributed in Canada, and its parasites will doubtless be found accompanying it. In September, 1888, at Hillsborough, N.B., at the head of the Bay of Fundy, a large proportion of the heads had one or more larvæ or puparia, and the easily recognized parasite, *C. Fletcheri*, was abundant. Last September the fly was found to be present at all points examined along the Intercolonial Railway in Nova Scotia, and was so abundant at Sydney, C.B., that fully fifty per cent. of the heads were infested.

THE GEOLOGICAL SOCIETY OF AMERICA.

The Fifth Annual and Winter Meeting of the Geological Society of America, as announced in the last issue of the NATURALIST, was held in Ottawa, Canada, beginning Wednesday, December 28th, 1892.

Through the kindness of Dr. J. G. Bourinot, C.M,G., of the Royal Society of Canada, and Clerk of the House of Commons, the ample and commodious Room of the Railway Committee of the House of Commons was placed at the disposal of the Society. There were about forty Fellows present—sixteen of whom came from various portions of the United States of America. The meeting was under the Presidency of Mr. G. K. Gilbert, Chief Geologist to the United States Geological Survey, Washington, whilst Prof. H. L. Fairchild, of the University of Rochester, was Secretary.

If we are to judge by the attendance and interest manifested at the meetings, as well as by the number and quality of the papers presented, there is no doubt that this meeting was a decided success.

A local committee composed of Fellows of the Royal Society, members of the Logan Club which comprise the scientific staff of the Geological Survey, etc., had made all necessary arrangements for the comfort and lodging of the members during the meeting. Dr. Selwyn as Chairman of the Committee, and Mr Smith as Secretary, spared no pains in giving the visiting Fellows of the Society a good reception.

The thanks of all are due to His Excellency the Governor General for the exceedingly kind and generous manner in which he devoted so much time and attention to the Society, besides furnishing the Fellows from a distance with an excellent opportunity of having a glimpse of social life at the Canadian capital by giving an "At Home" at Rideau Hall last Friday afternoon. To Dr. Ells, Mr. J. B. Tyrrell, Mr. Smith and others, much credit is also due for their exertions in making all necessary arrangements.

THE MEETINGS.

Shortly after ten o'clock on Wednesday, the 28th ult., President Gilbert took the chair and called upon His Excellency the Governor General to give the address of welcome.

His Excellency delivered a very neat address which was received enthusiastically. To this the President replied and referred to the proverbial hospitality for which Canadians were noted.

The report from Council was then made and the result of the vote announced so far as conclusions were arrived at. The following leading officers were then declared elected :—

President.....Sir J. William Dawson.
Secretary.....Prof. H. L. Fairchild.
Treasurer.....Dr. I. C. White.

The Secretary's report, as well as that of the Treasurer, showed the Society to be in a flourishing condition.

Then followed obituary notices of three deceased Fellows: T. Sterry Hunt, J. S. Newberry, and J. H. Chapin. Prof. Raphael Pumpelly's notice of Dr. Hunt was read by Mr. Van Hise ; that of Prof. Newberry, prepared by Dr. Kemp, was read by Prof. H. L. Fairchild; and Prof. Hitchcock read Mr. W. M. Davis's memorial of J. H. Chapin.

READING OF PAPERS.

The reading of papers or work proper of the Society began on Wednesday afternoon at 2 p.m. The following is a list of the papers, in the order in which they were taken up at the meetings. The whole time of the Society was taken up in reading and discussing papers until a late hour on Friday, the 30th December. Time and space do not allow us here to do justice to the interesting discussions on the papers presented. Both Glacial and Archæan Geology received a goodly share of animated discussion, whilst a few papers on palæontology also stimulated further enquiry. Dr. Willard Hayes's paper on "the new geology" was a splendid contribution to the geomorphology of the district examined by that author and described at the meeting.

LIST OF PAPERS.

A. R. C. Selwyn—On the coals and petroleums of the Crow's Nest Pass, Rocky Mountains. (15 minutes).

H. P. Brumell—On the geology of natural gas and petroleum in Ontario. (20 minutes).

H. P. BRUMELL—Note on the occurrence of petroleum in Gaspé, Quebec. (10 minutes).

ELFRIC DREW INGALL—Some features of the phosphate bearing rocks of Ottawa. (15 minutes). (Read by title).

SIR J. WILLIAM DAWSON—Note on sponges found in the Cambro-Silurian at Little Metis, Canada.

(Read in the absence of the author by Mr. F. D. Adams.)

J. F. WHITEAVES—Notes on the Devonian formation of Manitoba and the N. W. Territories. (5 minutes).

HENRY M. AMI—Notes on Cambrian fossils from the Selkirks and Rocky Mountain Region of Canada. (15 minutes.)

HENRY M. AMI—On the Potsdam and Calciferous terranes of the Ottawa Palæozoic basin. (10 minutes).

R. D. SALISBURY—Distinct glacial epochs, and the criteria for their recognition.

J. B. TYRRELL—Pleistocene phenomena in the region southeast and east of Lake Athabasca, Canada. (15 minutes).

A. P. LOW—Notes on the glacial geology of the Northeast Territories. (20 minutes.)

ROBERT CHALMERS—The height of the Bay of Fundy coast in the glacial period relative to sea level, as evidenced by marine fossils in the boulder clay at Saint John, New Brunswick. (20 minutes).

W. J. MCGEE — The Pleistocene history of northeastern Iowa. (20 minutes).

WARREN UPHAM—Eskers near Rochester, N.Y. (15 minutes).

WARREN UPHAM—Comparison of Pleistocene and present ice sheets. (30 minutes.)

G. FREDERICK WRIGHT — The post-glacial outlet of the Great Lakes through Lake Nipissing and the Mattawa River. (15 minutes.)

N. H. DARTON — On certain features in the distribution of the Columbia formation on the middle Atlantic slope.

GEORGE M. DAWSON—Note on the geology of Middleton Island, Alaska. (10 minutes). (Read by R. W. Ells.)

WALDEMAR LINDGREN—Two Neocene Rivers of California.

ROBERT W. ELLS—On the Laurentian of the Ottawa district. (20 minutes).

ROBERT BELL—The contact of the Laurentian and Huronian north of Lake Huron. (20 minutes).

W. H. C. SMITH—The Archæan Rocks west of Lake Superior. (15 minutes).

ALFRED E. BARLOW—On the Archæan of the Sudbury mining district. (15 minutes).

C. R. VAN HISE—The volcanics of the Huronian south of Lake Superior.

CHARLES ROLLIN KEYES — Some Maryland granites and their origin. (10 minutes.) (Read by Mr. U. S Grant).

CHARLES ROLLIN KEYES — Epidote as a primary component in granites. (15 minutes). (Read by Mr. U. S. Grant).

JAMES MCEVOY—Notes on the gold range in British Columbia. (15 minutes).

ISRAEL C. RUSSELL—A geological reconnoissance in the central part of the State of Washington. (25 minutes).

R. W. ELLS—The importance of photography in illustrating geological structure. (10 minutes).

J. W. POWELL—The work of the U. S. Geological Survey. (20 minutes). (Read by W. J. McGee.)

J. S. DILLER—Cretaceous and Tertiary rocks of the Pacific States.

T. W. STANTON—On the faunas of the Shasta and Chico formations.

C. WILLARD HAYES and M. R. CAMPBELL — Geomorphology of the southern Appalachians. (25 minutes).

N. H. DARTON—Overthrust faults in eastern New York (10 minutes) (Read by W. J. McGee).

The President's address on the "Problems of the Continents" was an admirable paper, which brings up and introduces a subject of paramount interest and importance. It serves as a preliminary basis for work in connection with the coming meeting of geologists at the International Congress, to be held in Chicago this summer.

Of Mr. W. J. McGee's public lecture, given in the new Auditorium of the Normal School, on the subject, "A Fossil Earthquake," seldom has an Ottawa audience listened to a clearer and more striking bit of inductive reasoning than this lecture. About 300 persons were present, and the lecture was illustrated by stereopticon views. Mr. H. N. Topley kindly assisted the lecturer in this matter.

After the reading of the last paper on the list and programme of Friday evening, three votes of thanks were unanimously passed by the Society.

The *first*, to the President and fellows of the Royal Society of Canada, for their invitation and attention during the Session of the Geological Society.

The *second*, to the Governor General, for his hospitality, and generous as well as the gracious interest he had taken in the meetings.

The *third*, to the Logan Club of Ottawa for its exertions in making the meeting a success.

One interesting feature of these meetings was the presence of the Premier of Canada, the Hon. Sir John Thompson, K.C.M.G., and of the Hon. T. M. Daly, Minister of the Interior and Geological Survey Departments, when Dr. McGee read the paper prepared by Major J. W. Powell, Director of the United States Geological Survey, on the work of that Survey. At the conclusion of the paper Sir John Thompson, Mr. Daly, M P., and Dr. Selwyn took part in the discussion. The comparative work and usefulness of the Geological Surveys of Canada and the United States was an interesting as well as practical question to statesmen of both countries.

Altogether, the meetings were most successful and teeming with interest. They were brought to a close with hopes of having another similar gathering at no distant date. H. M. Ami.

THE COUNTRY NORTH OF THE OTTAWA.

By Robt. W. Ells, LL.D., F.G.S.A.

Looking across the River Ottawa from the level terrace on which the Parliament Buildings are situated, we see rising to the north the series of hills known as the Chelsea Mountains, of which King's Mountain forms a prominent feature. Many of the readers of the *Naturalist* are familiar with these hills, since some of the pleasantest excursions of the Club have had them for their objective point. They rise out of the broad clay flat which extends for many miles along the course of the lower Ottawa, and consist, for the most part, of some variety of gneiss, with occasional bands of limestone. They constitute the oldest rock formation on the surface of our globe, and these rocks extend for many miles to the north, as well as to the east and west, presenting an exceedingly rugged landscape, densely clothed with forest. Where this has been removed by fires, the surface discloses great masses of rock, almost without a trace of vegetation or soil, on which such might grow. Valleys occur here and there among these hills, in which a certain amount of drift or decomposed rock has lodged, and here, for the space of several acres, conditions of soil and surroundings suitable for settlement exist. Large rivers traverse the district, and can be traced for hundreds of miles. Along these, and on many of their branches from either side, fertile areas extend, which have already been, to some extent, occupied by the hardy settler; but the area of these fertile lands, as compared with the great stretch of craggy hill and forest, is small. It was one of these settlers who, when told that his farm was situated upon the very backbone of the continent, replied with an air of disgust, that "it might very well be the backbone, but at any rate they had taken all the meat off it."

While, however, we have before our eyes daily the beautiful panorama of the Laurentian hills of the Ottawa District, it is surprising how very little is really known about the character and resources of the country lying immediately to our north. True it is that for many years the sound of the lumberman's axe, and the crash of the mighty pines have been heard; and the slash of the hunter in his lonely quest for furs, or the trail of the explorer in the search for mineral wealth, can be recognized in the heart of the most desolate wilderness. Yet beyond the narrow fringe of settlement, which skirts the northern bank of

the Ottawa, and extends upwards along its principal tributaries for nearly one hundred miles, we have but little reliable information. It is possible, therefore, that a few notes, founded upon a somewhat extensive two years' wanderings through this territory, may possess some points of interest to the readers of our journal, more particularly in view of the fact that, by means of canoes, many charming holiday excursions can be made along the network of streams and lakes, which intersect this northern country, presenting not only beautiful bits of natural scenery, but, to the student of nature, excellent opportunities for extending our knowledge of the plants, insects, birds, etc., of our more immediate vicinity.

Among the more important of the streams which traverse the Laurentian area north of the Ottawa, are the St. Maurice, the Rouge, the North Nation, the Lièvre, the Gatineau, and the upper part of the Ottawa itself; to the west of Ottawa city, are the Black, the Coulonge, the Dumoine and the Kippewa, by means of which, and by crossing short portages, the great chain of lakes lying to the north, for thirty to one hundred miles, are rendered easily accessible. Most of these lakes abound with fish, such as pike, bass and trout, while the woods are alive with deer. The Gatineau itself can be traversed for over 200 miles to its source, whence, by a short carry, it is possible to reach the Ottawa on the west, and then descend to Lake Temiscamingue; or, if it is preferred, an equally short portage will enable one to launch his canoe on the head-waters of the St. Maurice, by descending which, after a journey of about 250 miles, through some of the grandest scenery of the Laurentides, he can reach the St. Lawrence at Three Rivers, half way between Quebec and Montreal; or a route can be taken northward which will reach the country of Lake St. John, from which a descent can be made by the Saguenay. Along the Gatineau and the Rouge well constructed roads extend for over 100 miles, and thus anyone desirous of investigating the botany and other branches of natural history in this section, can very easily and quickly place himself in an almost entirely unknown country in this respect.

While it must be admitted that much of the country occupied by Laurentian rocks is rough and unfitted for agricultural pursuits, there are a great many areas, often of considerable extent, to which this remark will by no means apply. On the Gatineau and Lièvre, after

passing the first fifty miles, the country becomes more level, the elevations are more isolated, and a greater extent of fertile land, underlaid by calcareous rocks, is found, excellently adapted for the raising of grains, such as wheat and oats, and all kinds of root crops. Flourishing farms and comfortable houses are seen at many places, and the generally received opinion that the Laurentian country is unfitted for settlement speedily disappears. The fauna and flora of a portion of the district, or rather that area along the River Rouge, was studied by Mr. W. F. M. D'Urban, an assistant to Sir Wm. Logan, in 1858, and a partial list, relating to the mammals, fishes, insects and molluscs will be found in the appendix to the Geological Survey report for that year, while during the last two years a still further study of the plants of the district was made by Mr. R. McDougal, over a much wider area. Among the most abundant of the early flowering plants observed, was the Trailing Arbutus, (Epigæa repens) found near Ottawa, at Aylmer and Chelsea, but whose bunches of thick leaves were observed at many points to the North and East. This beautiful and exquisitely scented flower blooms in Nova Scotia as early as March, and in Gaspé was found in blossom in the last week in June. The graceful and fragrant Twin Flower forms perfect carpets in various places in this area, and many of the lakes in August are starred with the beautiful White Water-lily, some of which have blossoms of very large size, their cup-shaped flower sometimes measuring three inches in diameter.

In these Laurentian hills also are hidden great stores of mineral wealth. Mines of mica, graphite, apatite and asbestos are worked extensively in the immediate neighborhood of Ottawa, while the presence of the rarer minerals, such as garnets, zircons, tourmalines, scapolites and feldspars, in beautiful crystals, have made the district well known among collectors all over this continent.

If the members of our Club will bear in mind, when looking out for a pleasant trip for their next holiday season, that in the Laurentian country at our doors, there is a rich field for research in natural history, as well as all the requisites for a profitable outing in every way, we may expect before long to see the waters of our beautiful inland lakes disturbed by the paddles of our canoeists, while the cabinets of the students of plant and insect life will be enriched, and much additional material will be provided for the coming issues of the Ottawa Naturalist.

THE MINERAL WATERS OF CANADA.

By H. Peareth H. Brumell, F.G.S.A. (By permission of the Director of the Geological Survey Department.)

Though many mineral waters of high curative powers are known to occur in Canada, comparatively few of them have been as yet brought to the notice of the general public, the best known being undoubtedly those obtained from the springs at Wilmot, N.S.; Apohaqui and Havelock, N.B.; St. Leon, Ste. Genevieve and St. Hyacinthe, Que. Caledonia and Winchester Springs, Ont., and Banff, Alta. Regarding these, full particulars will be found in the following pages.

It is not the intention of the writer to touch in any manner upon therapeutics, but to confine himself in this case to the collection of analyses, which have been gleaned from many sources, including Dr. T. S. Hunt's article on Mineral Waters, constituting Chapter XVIII, Geology of Canada, 1863; Mineralogy of Nova Scotia, 1868, by Hy. How; Mineral Springs of the United States and Canada, 1874, by G. E. Walton, M.D.; various articles in the Canadian Naturalist and American Journal of Science, and the reports of the Geological Survey of Canada. The analyses marked thus (*a*) have been taken from Chap. XVIII, Geology of Canada, 1863.

Although by no means a complete list, it is considered amply sufficient to illustrate the fact that Canada has within her boundaries an almost endless variety of natural curative waters.

Mineral Waters in Ontario.

Alfred, Prescott Co. (*a*)—A Saline spring occurs on lot 9, range 10, of Alfred Township, which is said to contain 14·5 parts of solid matter in 1000 of water; and on lot 10, range 6, of the same township, two springs are said to occur, which yield saline, and somewhat alkaline waters, containing a small proportion of sulphates. These waters all rise from rocks of Cambro-Silurian age. No analyses are available.

Ancaster, Wentworth Co. (*a*)—About two miles east of the village of Ancaster is found a saline water, from which an attempt was, many years ago, made to obtain salt. Owing, however, to the low saturation

of the brine, and the great amount of earthy chlorides, the enterprise was unsuccessful. The analysis of a specimen, collected in September 1847, gave the following result :

Chloride sodium	17·8280
" potassium	·0920
" calcium	12·8027
" magnesium	5·0737
Bromide sodium	·1178
Sulphate of lime	·7769
Carbonate of lime	traces
In 1000 parts of water	36·6911
Specific gravity	1029·1

About one mile and three quarters north-west of the above spring occurs a sulphurous water, which issues from rocks of the Niagara formation. This water was analyzed in 1854 by Dr. Geo. Wilson, of Edinburgh, with the following result :

Chloride sodium	3·5476
" potassium	·0052
" calcium	1·3528
" magnesium	·4190
Sulphate of lime	·6500
Carbonate "	·2035
" magnesia	·0160
" iron	·0274
Silica	·0097
Iodine, Phosphoric acid, Alumina, Organic matter	traces.
In 1000 parts of water	6·2312

Sulphuretted hydrogen per 1000 inches of water. 56 c. in.

Bothwell, Kent Co.—In the "Thames Well," which was drilled in search of oil, a heavy flow of bitter sulphurous water was struck at a depth of 475 feet, and probably near the base of the Corniferous limestone. The water had a natural temperature of 57° F., and would, in consequence, be slightly thermal, as the region is traversed by the isothermal line of 47° F. The analysis (Report Geological Survey 1866, p. 273) showed :

Chloride sodium	14·4460	
" potassium	·3350	
" calcium	3·1830	
" magnesium	5·7950	
Sulphate of lime	3·0580	
Sulphide of sodium	·8797	·460 HS
" hydrogen	·0767	
In 1000 parts of water	27·7734	
Specific gravity	1020·9	

The waters from many of the wells sunk for oil throughout the district, and further north, in the Enniskillen oil region, show very similar characters, and are in many instances highly sulphurous.

Brampton, Peel Co. (*a*)—A water having in solution a small proportion of the alkaline chlorides and sulphates, is reported from this place, though the amount of solid mineral contents, 0·38 parts in 1000 of water, hardly places it in the category of mineral waters.

Brant, Brant Co. (*a*)—On lot 53, township of Brant, is found a copious spring, known as the "Blue Spring," from the intense blue colour of the water in the reservoir, which lies on a mound of calc tufa. The water both tastes and smells sulphurous, though no gas is evolved. A partial analysis afforded :

Sulphate of lime	1·240
" magnesia	·207
Carbonate of lime	·198
In 1000 parts of water	1·645

Brechin, Ontario Co.—A strongly saline water is found near this village, on the shore of Lake Simcoe, of which the following analysis has been made by Mr. Thos. Heys, of Toronto.

Chloride sodium	201·096
" potassium	5·480
" calcium	42·176
" magnesium	35·344
Sulphate of potash	3·968
Bicarbonate of soda	35 000
Carbonate of iron	2·160
Silica and alumina	1·744
Free ammonia	·120
Organic ammonia	·008
Grains in imperial gallon	327·096

Sulphuretted hydrogen ..... 105·26 c. inches.
Carbonic acid gas ..... 5·728 "

This water is now aerated and bottled in Toronto, by the proprietor, Mr. L. Forrest, and placed upon the market under the name of "Eudo" water.

Caledonia Springs, Prescott Co. (*a*)—In the village of Caledonia Springs, in the township of Caledonia, are located the springs which give rise to the name, and which have for many years been visited by persons suffering from many maladies, though more especially rheumatism and derangements of the digestive organs. Besides the water annually used in the sanitarium, large quantities are shipped to points both in the United States and Canada. The springs, four in number, are known as the "Gas," "Saline," "White Sulphur," and "Intermittent," the waters of which were collected and analyzed in September, 1847, with the following result:

	Gas Spring.	Saline Spring.	White Sulphur Spring.	Intermittent Spring.
Chloride sodium	6·9675	6·4409	3·8430	12·2500
" potassium	·0305	·0296	·0230	·0305
" calcium	.....	.....	.....	·2870
" magnesium	.....	.....	.....	1·0338
Bromide of sodium	·0150	·0169	·0100	.....
" magnesium	.....	.....	.....	·0238
Iodide sodium	·0005	·0014	traces.	.....
" magnesium	.....	.....	.....	·0021
Sulphate of potash	·0053	·0048	·0183	.....
Carbonate soda	·0485	·1762	·4558	.....
" lime	·1480	·1175	·2100	·1264
" magnesia	·5262	·5172	·2940	·8632
" iron	traces.	traces.	traces.	traces.
Alumina	·0044	undet.	·0026	"
Silica	·0310	·0425	·0840	·0225
In 1000 parts of water ..	7·7773	7·3470	4·9407	14·6393
Specific gravity	1006·2	1005·8	1003·7	1010·9

Accompanying the flow of water from the "Gas Well" there wa in 1847 a discharge of about 300 cubic inches of carburetted hydrogen per minute. This has, however, been much lessened through operations at the spring, and it is doubtful if the flow of gas at the time of the visit of the writer, in July, 1888, was more than half that amount. About twenty-five yards distant from the above spring are situated the "Saline" and "White Sulphur" springs, the former evolving a small quantity of carburetted hydrogen, and the latter a small quantity of sulphuretted hydrogen, equal to less than a cubic inch per gallon. The temperature of the water in the Gas, Saline and White Sulphur Springs, was found to be, in September, 1847: 44·4°, 45° and 46° F. respectively,

Charlotteville, Norfolk Co. (*a*)—On lot 3, con. 12, township of Charlotteville, is found a somewhat remarkable spring of sulphurous water, issuing from the Corniferous limestone. The water rises through several openings in the mud, at the bottom of a natural basin of about 100 square yards in extent, and was found to have a flow of about sixteen gallons per minute. It has a strongly pungent taste, from the great amount of sulphuretted hydrogen which it contains. By experiment at the spring this was found to be equivalent to 11·6 cubic inches in 100 of water. The temperature of the water in the basin at the time of examination—some thirty-five years ago—was 45° F. The solid matter amounted to 2·495 parts in 1000 of water, specific gravity, 1002·7. The analysis gave the following result for 1000 parts of water:

Chloride magnesium	·0878
Sulphate soda	·4718
" potash	·0510
" lime	1·1267
" magnesia	·4351
Carbonate lime	·3050
" magnesia	·0179
" iron	traces
Sulphuretted hydrogen	·1776

Craigleith, Gray Co—About midway between Collingwood and Meaford on the Georgian Bay are situated the "Blue Mountain Mineral Springs" in the village of Craigleith.

The water was examined by Mr. Thos. Heys of Toronto, who obtained the following results:

Chloride sodium	15·732
" potassium	·303
" calcium	6·937
" magnesium	3·125
Sulphate potassium	·983
Carbonate calcium	1·462
Volatile organic matter	5·625
Grains in imperial pint	34·167
Carbonic acid gas	·621 cubic inches
Sulphuretted hydrogen	·526 cubic inches
Temperature	45·5° F.

Eastman's, Russell Co.—The waters of the two springs at Eastman's Springs, and known as the "Sulphur" and "Saline" were examined by Mr. G. C. Hoffmann, Chemist to the Geological Survey (Geol. Sur. rep. 1874-75 p. 317), with the following results:

	Sulphur Sp.	Saline Sp.
Chloride sodium	2·1584	18·9812
" potassium	·0400	·1577
" calcium	.....	4·1692
" magnesium	.....	1·9031
Sulphate potash	·0033	.....
" lime	.....	·0199
Bicarbonate soda	·8365	.....
" lime	·0549	·1773
" magnesia	·1709	.....
" iron	·0066	·0121
Ferric oxide	.....	·0311
Alumina	traces	·0022
Silica	·0124	·0090
Organic matter	·0917	.....
Copper	.....	minute trace
Lithia	undet	undet
Baryta	minute trace	"
Strontia	.....	"
Boracic acid	undet	.....
Bromine	.....	undet
Iodine	undet	undet
Phosphoric acid	undet	undet
	3·3747	
Less carbonic acid actually found	·0117	
In 1000 parts of water	3·3630	25·4628
Specific gravity	1001·95	1019.44

Fitzroy, Lanark Co.(*a*)-- A saline water is found rising from rocks of the Chazy or Calciferous formation, on lot 10, range 2, Fitzroy township, at what is known as Gillan's spring. A specimen collected in July 1850, afforded the following results on analysis:

Chloride sodium	6·5325
" potassium	·1160
Bromide sodium	·0217
Iodide "	·0032
Phosphate soda	·0124
Carbonate "	·5885
" baryta	traces
" strontia	"
" lime	·1500
" magnesia	·7860
" iron	traces
Alumina	·0040
Silica	·1330
In 1000 parts of water	8·3473
Specific gravity	1006·24

Another water, which is feebly saline, and sulphurous to the taste, but which was not analyzed, occurs on lot 12, con. 6, of the same township.

Hallowell, Prince Edward Co. (*a*)—On lot 11, con. 2, township of Hallowell, a well twenty-seven feet in depth, and known as Hubb's well, afforded a water, of which the following analysis of a specimen collected in Oct., 1853, was obtained—Analysis I; while from a well about two miles distant, a specimen was obtained in the summer of 1854, affording the result shown in II. The waters of several wells in the vicinity were found to be very similar in character to these two.

	I	II
Chloride sodium	38·7315	17·4000
" potassium	traces	.....
" calcium	15·9230	9·2050
" magnesium	12·9060	9·4843
Bromide sodium	·4685	undet
Iodine "	·0133	"
In 1000 parts of water	68·0423	36·0893
Specific gravity	1053·11	.....

Hamilton, Wentworth, Co. (*a*)—In the Canadian Journal 1853. Prof. Henry Croft gives the the following analysis of a water said to be from Young's Spring at Hamilton:

Chloride sodium	·5098
Sulphate soda	1·6985
" lime	1·1246
" Magnesia	4·7799
In 1000 parts of water	8·1128
Specific gravity	1006.4

Hawkesbury, Prescott Co. (*a*)—A well reported to be on lot 9 con. 6 township of Hawkesbury afforded a water which gave the following result on partial analysis:

Chloride sodium	8·177
Sulphate soda	·083
Carbonate soda	1·200
" lime	·076
" magnesia	·063
In 1000 parts of water	9·599

As well as some undertermined bromides, iodides, boracic acid, oxide of iron and silica.

Kingston, Frontenac Co. (*a*)—In two borings made for water at Morton's distillery in Kingston, mineral waters were encountered specimens of which were examined by the Rev. Prof. Williamson of Queen's College, Kingston, with the following results.

	Lower Well.	Upper Well.
Chloride sodium	5·215	29·864
" calcium	4·010	12·894
" magnesium	1·763	6·954
Sulphate soda	2·441	.....
" lime		·396
" magnesia		·492
Carbonate lime	·400	·370
" magnesia		1·287
In 1000 parts of water	13 830	52.257
Specific gravity	1010·0	1043·2

London, Middlesex Co.—Unfortunately no data are at hand giving an accurate analysis of the water of the Sulphur spring at London.

(*To be continued.*)

BOOK NOTICE,

The Butterflies of North America, 3rd Series, Part XII.

The last part of Mr. W. H. Edwards's magnificient work has just appeared. For beauty of illustration and interest to Canadian Lepidopterists, it surpasses all previously issued parts. The first plate shows the type of *Chionobas Chryxus*, var. *Calais*, Scudder, from Hudson's Bay and a similiar form which is found at Banff in the Rocky Mountains. The second plate shows in full all the different stages of the rare Canadian species, *C. Jutta*. This insect has been twice taken at Ottawa. A special expedition having been arranged to visit the Mer Bleue in the end of June last. The day was very unpropitious, and only one specimen was seen. This was run down and captured after a hard chase. The species has been taken in restricted localities in Maine, at Quebec, Ottawa, Nepigon and in the Rocky Mountains. There are some interesting points in its life-history which need clearing up and we recommend the subject to our local members, as an opportunity for doing good scientific work. The third plate shows two more rare species of the same genus, *C Crambis* from Labrador and *C. Brucei*, which is said to have been taken at Banff by Mr. T. E. Bean.

Mr. Edwards's great work is indispensable to all Lepidopterists, and we have lately learnt with great pleasure that $500 has been granted from the "Bache Fund" of the American National Academy towards the publication of this important contribution to scientific knowledge.

J. F.

ENTOMOLOGY.

Edited by W. Hague Harrington.

Among the less common coleoptera taken during the past year may be mentioned the following species:

Chlænius niger, Rand, of which a specimen was taken near Dow's Swamp on April 30th. This is our rarest species of Chlænius, only two specimens having been taken by me previously, one in Stewart's bush, (now nearly disappeared), on May 6th, 1883, and one near Hull on May 17th, 1890.

Chlænius tomentosus, Say. This species is also not common, but a specimen was taken in the same locality, on the slope of the dam, between the canal and the swamp, on May 23rd. In shape it closely

resembles the former species, but it is larger, and the elytra are tomentose with a fine silky pubescence.

Lacnocrepis parallelus, Say. One of these beetles was taken on the same date as the preceding and in the same locality, where two or three specimens had been collected by Rev. G. W. Taylor two years previously. The only other example I have from this district is one given to me by Mr. W, Simpson, and collected I believe at King's Mere.

Dromius piceus, Lec. was another interesting species taken the same day under the bark of a stump. This carabid, easily recognized by its truncated elytra is usually found either under bark, or under moss about the roots of trees, in such places as the damp woods in this swamp.

Brachys ovata, Web. An example of this pretty little buprestid was secured at Wakefield on August 7th upon oak. It may readily be distinguished, by it greater size and more purplish color, from our common *B. ærosa* which is taken upon basswood.

Typocerus zebratus, Fab. is a longicorn beetle which occurs in the latter part of July and in August upon the flowers of the golden-rod, and was taken last season at Wakefield and Aylmer. It is distinguished from our commoner species *T. velutinus* Oliv. by being smaller and by having the elytra black with four bright yellow bands, instead of red with the bands pale yellow, The members of the genus Typocerus are distingushed from the more numerous species of Leptura by the large poriferous spaces on the antennæ.

Bruchus cruentatus, Horn. This pretty little beetle, marked with a bright-orange-red patch on each elytron, was taken at Aylmer on July 31st in the blossom of the wild convolvulus (upon which were many pupae and beetles of of the spotted tortoise-beetle, *Chlymorpha argus* Licht.) A second specimen was observed and taken with the sweeping net, but escaped with the nimbleness that characterises this species. The only specimens previously taken or seen, occurred several years ago in the city.

Mycterus scaber, Hald. Several of this species were taken upon flowers (compositæ) at Aylmer on 31st July. The only previous capture of this melandryid was on the occasion of a Club excursion to the Chats Falls some years ago, when it was somewhat abundant upon small willows.

Calopus augustus, Lec. This addition to the local list was made by Mr. Fletcher, who picked up a dead and badly mutilated female on one of our streets. The insect was recognized in the collection of Mr. Evans of Sudbury who has taken there two or three examples.

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A GLACIAL EPOCH.

By W. Hague Harrington.

At the dinner given by the Logan Club to the Geological Society of America, one of the learned speakers, in the course of a humorous speech, remarked that he and his fellow-scientists had come north to Ottawa to study the glaciers in their native land. At that date the "good old-fashioned winter" was just in its youth, but it has since been a subject of general interest, and of equally general—conversation. I have heard "the oldest inhabitants" going back for terrible instances to '59, and even to '37, at which ancient periods the glaciers had apparently hardly withdrawn from the Ottawa Valley to judge from the "cold waves" then experienced.

Through the courtesy of Prof. Carpmael I have obtained for the benefit of those interested in the recent cold spell, the following table. It will be observed that there was no unusually low reading of the thermometer, the lowest being – 26.2 on January 4th. By reference to some yearly abstracts published in earlier transactions of the Club, it will be seen that there were lower readings in those years, viz: December, 1884, – 28.3; February, 1885, – 26.9; January, 1886, – 26.5, and January, 1887, – 31.6. The severity of the five weeks covered by the following table was due to the almost unbroken cold, the record showing that the temperature fell below zero on 28 days, that it averaged below zero on 16 days, and that on 6 days it was not above zero. The average for the 35 days was only 1.91 above zero. With this may be compared the very cold February of 1885, which averaged 4.40, and the January of 1887, when it averaged 4.33. A very severe day was Dec. 24th, when, with an average temperature of – 1.2, the average velocity of the wind was 22⅓ miles per hour. The coldest day was January 11th, when the average was – 17.8, and the maximum – 10.8; the wind averaging 14⅕ miles per hour.

ABSTRACT OF METEOROLOGICAL OBSERVATIONS AT OTTAWA,
for the period Dec. 18th, 1892, to Jan. 21st, 1893, inclusive.

Date.	Max. Tp.	Min. Tem.	Mean. Tem.	Wind-Ms
	°	°	°	
Dec. 18	14.9	—3.5	11.23	71
" 19	34.0	13.0	21.92	182
" 20	13.8	—7.5	3.05	157
" 21	18.2	2.5	7.47	102
" 22	3.8	—8.2	—4.25	198
" 23	—4.1	—15.0	—5.77	191
" 24	1.0	—8.2	—1.20	536
" 25	2.5	—13.5	—4.05	236
" 26	3.2	—18.3	—3.37	221
" 27	8.0	—1.2	3.12	166
" 28	10.0	—4.2	2.10	36
" 29	10.0	—5.5	3.87	3
" 30	20.1	—2.2	13.65	1
" 31	34.6	12.8	21.25	73
Jan. 1	29.8	18.2	26.35	212
" 2	35.2	15.8	23.30	363
" 3	17.5	—16.1	—10.35	289
" 4	—6.2	—26.2	—13.70	4
" 5	6.8	—19.6	2.47	92
" 6	12.7	—1.2	5.13	101
" 7	4.5	—5.5	—0.90	148
" 8	0.9	—14.6	—8.50	123
" 9	5.7	—16.3	2.00	161
" 10	9.8	—12.5	—8.87	366
" 11	—10.8	—21.6	—17.80	341
" 12	—1.2	—24.1	—6.50	28
" 13	3.0	—9.2	—3.75	61
" 14	—0.5	—14.3	—7.75	5
" 15	0.0	—22.2	—7.95	4
" 16	5.5	—10.5	0.92	49
" 17	8.6	—1.5	3.45	2
" 18	5.3	—2.0	3.45	108
" 19	11.8	3.2	9.10	110
" 20	12.0	0.5	9.15	172
" 21	8.8	—10.2	—1.15	80
Average	9.41	—7.11	1.91	142.6

EVENING LECTURES.

During the past month two most successful meetings of the Club have been held. On January 5th, Prof. John Macoun, Botanist, and Naturalist of the Geological Survey Department, delivered a most entertaining lecture on the Fauna and the Flora of the Selkirk summits. The large audience listened attentively while the lecturer discoursed upon the many and varied features of that remarkable range of mountains, the natural history of which he has examined more critically than any other living man. At the conclusion of the lecture, many questions were asked as to the altitudes which certain trees reached. The discussion was joined in by Messrs. J. Craig, H. M. Ami, A. G. Kingston and J. Fletcher. A paper on the Mineral Waters of Canada by Mr. H. Peareth Brumell of the Geological Survey Department was read by title.

January 19th, Food in Health and Disease, was ably treated by Dr. L. C. Prévost, who kept the attention of one of the largest audiences which has ever honoured the club. The subject, which is necessarily of interest to every one, was rendered more than usually attractive by the Doctor's original manner of presenting it, and the only regret of those present was that they could not enjoy in a material sense the many tempting luxuries mentioned in the bill of fare, given by the lecturer as a *menu* for the dinner which he described so graphically, and at which he invited them to join him. A cordial vote of thanks was proposed by Mr. J. Fletcher and seconded by Mr. J. G. Whyte.

THE FOLLOWING ARE THE TITLES FOR THE FEBRUARY LECTURES:

Feb. 2.—"Narrative of a Journey in 1890, from Great Slave Lake to Beechy Lake, on the Great Fish River," from the journal of Mr. James McKinley, Officer in charge at Fort Resolution, H.B. Co.—MR. D. B. DOWLING.

Feb. 16.—"The Development of Varieties and the Multiplication of Individuals in Horticulture."—MR. JOHN CRAIG.

"My Aquarium."—MR. H. B. SMALL.

MINERAL WATERS OF CANADA.

(*Continued from Page 167.*)

This water has been used for many years in connection with baths erected over the well, where, at a depth of 114 feet from the surface, the water was struck. An analysis by Prof. Croft gave about two parts of solid matter in 1,000 of water; these consisted of nearly equal parts of the sulphates of lime and magnesia and traces of chloride of sodium, The water deposits pure yellow pulverulent sulphur around its outlet. (*Vide* report Geol. Surv., 1863-66.)

Manitoulin Islands—In well No. 1, sunk by the Manitoulin Oil Co., at a depth of 192 feet from the surface or 60 feet beneath the summit of the Trenton limestone, an intensely bitter saline water was encountered; the following analysis was made by Dr. T. Sterry Hunt:

Chloride sodium	4·800
" potassium	·792
" calcium	12·420
" magnesium	3·650
In 1,000 parts of water	21·662

The water was not examined for bromides or iodides which were, according to the analyst, probably present.

Niagara, Lincoln Co.—Full data are not at hand regarding a somewhat well-known gas spring at Niagara, which by reason of the great quantities of inflammable gas given off, is in a constant state of ebullition and is known as the "Burning Spring." The water rising from rocks of the Medina formation is peculiarly styptic and acid to the taste, and contains a very large proportion of sulphuric acid. The mean of two analyses gave Dr. Sterry Hunt 2·1376 parts of the acid ($S O^3$) to 1,000 parts of water.

Another spring, similar in character to the above, is noted about a mile and a half above Chippewa and near the Niagara river, wherein the water was found to be somewhat stronger in sulphuric acid. This latter water rises from the Onondaga formation.

Otonabee, Peterborough Co.—An examination was made by Mr. G. C. Hoffmann (report Geol. Surv., vol. IV, 1888-89, part R) of water from a boring on the west half of lot 26, concession 4, township of Otonabee, with the following result:

Chloride sodium	3·8403	Alumina	·0008
" potassium	·0770	Silica	·0153
" calcium	·4088	Organic matter	traces
" magnesium	·4797		
Sulphate lime	·0019	In 1,000 parts of water	5·0824
Carbonate lime	·2536	Specific gravity at 15.5° c	1003·91
" iron	·0050		

Of the physical character of the sample Mr. Hoffmann writes:— "On opening the bottles a slight, but decided, odour of petroleum was noticeable. The water contained a considerable amount of suspended matter. This was filtered off and examined—it consisted of argillaceous matter, very fine sand, partially decomposed fragments of wood, fragments of seed-cases and other vegetable matter, together with some carbonate of lime, small amounts of carbonate of magnesia and iron, and a very small amount of suphate of lime. The filtered water, when viewed in a column two feet in length, was found to have a faint brownish tinge. Taste, mildly saline. Baryta was not sought for. The presence of iodine and bromine requires confirmation."

Plantagenet, Prescott Co. (a)—Three springs are known to exist in this township, only two of which are, however, at all well known, viz.: The "Plantagenet" and the "Georgian" springs, and of which the following analyses are available:—

Chloride sodium	11·6660	9·4600
" potassium	·1040	·1040
" calcium	·1364	·0443
" magnesium	·2452	·4942
Bromide "	·0080	·0029
Iodide "	·0052	·0017
Sulphate lime	.....	·1929
Carbonate lime	·0330	·2980
" magnesia	.8904	·3629
" iron	·0096	trace
Alumina	traces	undet
Silica	·0700	·0205
In 1,000 parts of water	13·1678	10·9814
Specific gravity	1009·39	1008·78

Another spring similar to the "Plantagenet" yielded 10·16 parts of solids in 1000 of water and held a comparatively large amount of strontia and traces of boracic acid.

Port Elgin, Bruce Co.—A partial analysis of a mineral water from a spring at this place was made by Mr. G. C. Hoffmann (report Geol.

Surv., vol. II, 1886, p 12 T), showing the water to contain the following :

Potassa	trace	Ferrous oxide	trace
Soda	fairly large quantity	Sulphuric acid	very large quantity
Lithia	trace	Phosphoric acid	trace
Strontia	small quantity	Silica	"
Lime	very large quantity	Chlorine	very large quantity
Magnesia	large quantity		

The water at 15·5° C. had a specific gravity of 10·0269, and contained 2·925 parts of dissolved saline matter in 1000 of water.

Sandwich, Essex Co.—At this place is located a sulphurous spring, near which was erected an hotel and baths ; owing, however, to the loss of the hotel and bathhouses by fire, the spring has of late years fallen into disrepute. The water is highly sulphurous and flows from an artesian boring made some years ago for oil.

The analysis, according to Prof S. P. Duffield, gave the following result :

Chloride sodium	0·070	Carbonate lime	4·813
" calcium	0·007	" magnesia	1·618
" magnesium	19·220	Silica	0·014
Sulphate lime	15·479		
Carbonate soda	6·070	Grains in one pint	47·291
" potassa	traces		

GASES.

Carbonic acid, cubic inches	1·25
Sulphuretted hydrogen, cubic inches	4·72
Nitrogen, cubic inches	0.09

As may be seen on reference to the above, the waters of this well contain a considerable proportion of chloride of magnesium and sulphuretted hydrogen.

St. Catharines, Lincoln Co. (a)—Some years previous to 1863 an attempt was made to obtain brine, for the manufacture of salt, at St. Catharines. With this object, a well was drilled in the town to a depth of about 500 feet, the drill penetrating the Hudson River shales to a distance of 50 to 60 feet.

A brine of low saturation was obtained but owing to the contained lime and magnesia salts was never used in the making of salt.

This water was analysed by Prof. Croft of Toronto as given below I.

In 1861 a second boring was made by Mr. E. S. Adams resulting in the discovery of a water of similar character. Analysis II.

	I	II
Chloride sodium	29·8034	19·94
" potassium	·3555	undet
" calcium	14.8544	6·49
" magnesium	3·3977	1·95
Iodide sodium	·0042	undet
Sulphate lime	2·1923	1·77
In 1,000 parts of water	50·6075	30·15
Specific gravity	1036.0	.....

This water (I) acquired quite a reputation locally and was partly evaporated and shipped in a concentrated state. Of this concentrated water, the following analysis, made by J. R. Chilton, M.D. 1853, is given in "The mineral springs of the United States and Canada, by Geo. E. Walton, M.D. New York 1874"

Chloride sodium	781·36	Sulphate lime	16·32
" calcium	2950·40	Carbonate magnesia and lime	2·08
" magnesium	1289·76	Silica, alumina, and lithia	2·47
Bromide "	2·01		
Iodide "	2·11	Grains in one pint	5,060·27
Proto-chloride iron	13·76		

"The large amount of proto-chloride of iron was probably formed from the surface of the iron vessel during evaporation."

"These celebrated waters are the most perfect type of iodo-bromated water known in this country. They very much resemble the celebrated waters of Krueznach, in Prussia, though containing the chloride of sodium, calcium and magnesium in much larger proportions." *Vide report referred to above.*

Silver Islet, Lake Superior.—The following analysis was made by Mr G. C. Hoffmann (report Geological Survey Vol. I, 1885, p. 17 M) of a specimen of water collected at the Silver Islet mine by Capt. Trethewey in 1882.

Chloride sodium	16·8098	Manganese	traces
" potassium	·4582	Cobalt	traces
" calcium	17·0867	Silica	·0540
" magnesium	1·2939		
Sulphate lime	·0672	In 1,000 parts of water	36·0634
Carbonate lime	·2936	Specific gravity at 15·5° C	1028·48

The water was colourless; odourless; taste, strongly saline with slight bitter after taste; reaction, neutral.

Tuscarora, Brant Co. (*a*)—On the Indian Reserve in this township and about nine miles south of Brantford and three miles south of the Grand River, is located what is known as the "Sour Spring of

Tuscarora." The waters of this spring form several pools of from three to four feet in diameter, where owing to a constant discharge of inflammable gas the water is in a state of agitation. In appearance it is slightly turbid and brownish and has a peculiar styptic, acid and sulphurous taste. Analysis showed the water to contain, in October 1847 :

Sulphate soda	·0502	Phosphoric acid	traces
" potash	·0608	Hydrated sulphuric acid (SO_3, H_2O)	4·2895
" lime	·7752		
" magnesia	·1539	In 1,000 parts of water	6·1615
" protoxide of iron	·3638	Specific gravity	1005·58
" alumina	·4681		

Westmeath, Renfrew Co. (*a*)--In the Geology of Canada 1863, on page 547, is given the description of two springs in this township as follows :—"On the thirteenth lot of the sixth range of Westmeath is a spring which deposits a considerable amount of calcareous tufa and is known as the Petrifying Spring". The water contains, besides carbonate of lime, small quantities of chlorids, and is feebly sulphurous. On the twenty-third lot of the same range, a copious spring, occurs on Tucker's Creek. It contains a large amount of carbonate of lime, and a little iron ; besides which, it holds only traces of sulphates and chlorids."

Whitby, Ontario Co. (*a*)—A copious spring of saline water is met with at Bowerman's Mills on lot 32, concession 3, township of Whitby where the water rises from rocks of the Trenton series, The following analysis was made of a specimen collected in October 1853 :—

Chloride sodium	18·9158	Carbonate lime	·0411
" potassium	traces	" magnesia	·0227
" calcium	17·5315	" strontia	traces
" magnesium	9·5437	" iron	traces
Bromide sodium	·2482		
Iodide "	·0008	In 1,000 parts of water	46·3038

MINERAL WATERS IN QUEBEC.

Ascot, Sherbrooke Co.—The water of a spring near the Belvedere Iron mine and on lot 8, range 9, township of Ascot was examined during 1887 in the laboratory of the Survey (rep. Geol. Surv. Vol. III, 1887-88, p. 22 T) with the following result :—

Potassa	trace	Sulphuric acid	large proportion
Soda	small proportion	Carbonic acid	small proportion
Lime	rather large proportion	Silica	trace
Magnesia	" " "	Chlorine	small proportion
Ferrous oxide	trace		

" Total discovered saline matter, dried at 180° c., equalled 0·0746 parts in 1,000.

Baie du Febvre, Nicolet Co. (*a*)—The waters of four springs in the seigniory were examined, though of these the analysis of but one is preserved in its entirety. The analysis given below is that of a water from Courchênes spring about one and a half miles east of St. Antoine church Grand Range, and was collected in September 1852.

Chloride sodium	4·8334	Carbonate lime	·2180
" potassium	·0610	" magnesia	·4263
Bromide sodium	undet	Alumina	undet
Iodide sodium	undet	Silica	·2120
Carbonate soda	1·5416		
" baryta	trace	In 1,000 parts of water	7·2923
" strontia	trace		

The three other springs afforded waters containing solids to the extent of 5·44, 15·94 and 4·96 parts in 1,000 of water, All of these waters probably rise from rocks of the Hudson River formation.

Bay St. Paul, Charlevoix Co. (*a*)— Several mineral waters are obtained in the neighbourhood of Bay St. Paul of which, however, no detailed analyses are available. A sample from one of these springs contained 20·68 parts of solid matter in 1,000 of water and had a bitter saline taste.

Belœil, Verchères Co. (*a*)—A mineral water from this seigniory which rises from the Hudson River formation affords the following:—

Chloride sodium	5·9662	Carbonate magnesia	·4756
" potassium	undet	" iron	traces
Bromide sodium	"	Alumina	undet
Iodide sodium	"	Silica	·1140
Carbonate soda	·6082		
" strontia	·0250	In 1,000 parts of water	7·3330
" lime	·1440		

Berthier, Berthier Co. (*a*)—About three miles above the church at Berthier and on the Bayonne River is found a copious spring of saline water, of which a specimen collected in July 1853, afforded the following analysis :—

Chloride sodium	8·0454	Iodide magnesium	traces
" potassium	undet	Carbonate lime	·0470
" calcium	·0466	" magnesia	·8354
" magnesium	·0856		
Bromide magnesium	undet	In 1,000 parts of water	9·0600

Caxton, St. Maurice Co. (*a*)—A saline spring rising from Cambro-silurian limestones, occurs in the township of Caxton on the banks of the Yamachiche river. The water is accompanied by very considerable quantities of carburretted hydrogen gas and had at the time of the collection of the specimen examined, October 1848, an estimated flow of eight gallons per minute. It afforded the following analysis:—

Chloride sodium	11·7750	Carbonate magnesia	1·0593
" potassium	·0800	" iron	·0054
" calcium	·0503	Alumina	·0050
" magnesium	·3743	Silica	·0479
Bromide "	·0342		
Iodide "	·0039	In 1,000 parts of water	13·6513
Carbonate lime	·2160	Specific gravity	1010·36

Chambly, Chambly Co. (*a*)—Several springs occur in the immediate neighborhood of Chambly, the waters of which are in all cases feebly saline. One of these, about three miles above the village in the Range des Quarantes, affords a very considerable quantity of saline water, containing 5·74 parts of solid matter in 1,000 of water and abundance of carburetted hydrogen gas. Temperature of water 53° F.

Another spring occuring on the Grand Coteau gave the following analysis of a specimen collected there in October 1852.

Chloride sodium	·8387	Carbonate iron	·0024
" potassium	·0324	Alumina	·0063
Carbonate soda	1·0604	Silica	·0730
" strontia	·0045		
" lime	·0380	In 1,000 parts of water	2·1322
" magnesia	·0765	Temperature of water	53° F.

Henryville, Iberville Co. (*a*)—A water containing a large amount of carbonate of soda, with chlorides, and a trace of iodides occurs about two miles south of this place. The water at the time of examination, prior to 1863, contained 16 cubic inches of sulphuretted hydrogen in 1,000 cubic inches of water. No analysis is available.

Jacques Cartier River, Portneuf Co. (*a*)—A water strongly impregnated with sulphuretted hydrogen rises from the Utica formation near Marcotte's Mills on the Jacques Cartier river, near Quebec. The specimen examined was collected in the summer of 1852 and gave:—

Chloride sodium	·0347	Carbonate magnesia	·0278
" potassium	·0076	Alumina	undet
Sulphate potash	traces	Silica	·0110
Carbonate soda	·1952		
" lime	·0710	In 1,000 parts of water	·3473

Joly, Lotbinière Co. (*a*)—A sulphurous water is found in this township on the Magnetat Brook about five miles from Methot's mills. The water is feebly saline and contains a portion of boracic acid, besides sulphuretted hydrogen equal to 75 cubic inches per litre. A specimen collected in July 1853, afforded the following analysis :—

Chloride sodium	·3818	Carbonate magnesia	·0257
Chloride potassium	·0067	Alumina	undet
Sulphate soda	·0215	Silica	·0245
Carbonate soda	·2301		
" lime	·0620	In 1,000 parts of water	·7523

Lanoraie, Berthier Co. (*a*)—A saline spring occurs at a point about midway between the village of Lanoraie and Industry. The water evolves large quantities of carburetted hydrogen and contains somewhat large proportions of baryta and strontia as shown in the following analysis of a specimen collected in March 1851.

Chloride sodium	11·1400	Carbonate strontia	·0137
" potassium	·1460	" lime	·4520
" barium	·0303	" magnesia	·4622
" strontuim	·0185	" iron	traces
" calcium	·2420	" Alumina	undet
" magnesium	·2790	" Silica	·0552
Bromide "	·0283		
Iodide "	·0052	In 1,000 parts of water	12·8830
Carbonate baryta	·0106	Specific gravity	1009·42

L'Assomption, L'Assomption Co. (*a*)—A saline water which some years ago was used quite extensively and was somewhat widely known is found in the range of Point du Jour, near the village of L'Assomption. The spring, known as the "Aurora spring" rises from Cambro silurian rocks and an analysis of its waters showed them to contain 7·36 parts of solid matter in 1,000 of water as well as considerable quantities of carburetted hydrogen.

Longueuil, Soulanges Co. —In the report of the Geological Survey Vol. I. 1885 page 12 M is given the analysis of a water from a spring in this seigniory and which rises from rocks of the Chazy formation. The spring has an estimated flow of about 450 gallons per minute and the water was odourless and practically tasteless. The analysis gave the following result :—

Chloride sodium	·0021	Silica	·0092
Sulphate soda	·0078		
" potassa	·0028		·1482
" lime	·0233	Carbonic acid, half combined	·0483
Carbonate lime	·0673	" " free	·0128
" magnesia	·0357		
" iron	traces	In 1,000 parts of water	·2093
		Specific gravity at 15·5° C.	1.000·16

Maisonneuve, Hochelaga Co. (*a*)—An examination was made by Mr. G. C. Hoffmann in the laboratory of the Survey (report Geol. Surv Vol. IV. 1888-89. part R.) of a water from a deep boring on the property of Messrs Viau et Freres at Maisonneuve, near Montreal. The boring attained a depth of 1.500 feet, in rocks of Cambro-silurian age from which the water emanated. Of the physical features of the specimen, Mr. Hoffmann writes as follows:—

"The sample of water sent for examination had, when received, a faint yet decided odour of sulphuretted hydrogen; it contained but a trifling amount of sediment; colour of the clear water, when viewed in a column two feet in length, light yellow; taste, mildly saline; reaction, faintly alkaline."

The analysis gave the following result:—

Chloride sodium	4·0358	Silica	·0135
" potassium	·0301		
Sulphate soda	2·8624		7·3587
" lime	·0867	Carbonic acid, half combined	·1658
Carbonate lime	·0855	" " free	·0503
" magnesia	·2447		
Alumina	trace	In 1,000 parts of water	7·5748
		Specific gravity at 15·5° C.	1006·31

Quarante Arpents, Nicolet Co. (*a*)—Near the line of St. Gregoire and in the concession of Quarante Arpents occurs an alkaline water, impregnating a small area of marshy ground in which a pit was dug and the specimen, of which the following is an analysis, collected in the Autumn of 1853. The water is yellowish and alkaline in taste, and rises from rocks of the Hudson River formation:—

Chloride sodium	·3290	Carbonate iron	undet
" potassium	·0318	Alumina	"
Sulphate potash	traces	Silica	"
Carbonate soda	1·1353		
" lime	undet	In 1,000 parts of water	1·5591
" magnesia	"		

Rawdon, Montcalm Co. (*a*)—In the "Geology of Canada" 1863, page 541 the following description of two springs in this township is found:—

"Two springs have been examined from the township of Rawdon. One of the third class from the twenty-fifth lot of the third range, is somewhat strongly saline, containing 4·96 parts of solid matter, in 1,000, and yielding the reactions of baryta, boracic acid, bromine and iodine. The other from the twenty-seventh lot of the same range is an abundant spring, of slightly sulphurous water, belonging to the fourth class, which yields only 0·32 parts of solid matter in 1,000 and contains portions of sulphates and borates, with a trace of bromine. These springs apparently rise from the Potsdam formation."

Rivière Ouelle, Kamouraska Co. (*a*)—In the third concession of the seigniory of Rivière Ouelle, are several small basins wherein is found a saline water. No analyses are available though a partial examination showed the water to contain 13·36 parts of solid matter made up principally of chlorides of calcium and magnesium and a small proportion of earthy chlorides, in 1,000 parts of water.

Ste. Anne de la Pocatière, Kamouraska Co. (*a*)—Several saline springs are known to exist in this seigniory of which however no analyses are available. Two of these, mentioned in the "Geology of Canada, 1863" as occuring in the second concession gave 0·36 and 5·06 parts of solid matter in 1,000 of water, the latter amount (5·06) being contained in a bitter saline water holding besides chlorides an abundance of the sulphates of lime and magnesia. The water affording 0·36 parts is slightly sulphurous and is strongly saline to the taste.

St. Benoit, Two Mountains Co. (*a*)—"A spring nearly opposite to the old church of St. Benoit, rises thorough the clays, which here overlie the Potsdam formation. The specific gravity of the water is 1004·3, and it contains about 6·0 parts of solid matter to 1,000. This water * * * * contains traces of carbonates, and large amounts of calcareous and magnesia salts, both chlorides and sulphates" vide Geology of Canada, 1863.

St. Eustache, Two Mountains Co. (*a*)—A feebly saline water, yielding 1·88 parts of solid matter to 1,000 of water and rising from rocks of the Trenton formation occurs near the village of St. Eustache in the parish of that name.

Ste. Geneviève, Batiscan Co. (*a*)—Several medicinal springs are known to occur in the vicinity of St. Genevieve and near to the Batiscan river. The waters which are strongly saline, flow from rocks of Trenton age, and in the case of that, of which No I is the analysis, give off no inconsiderable quantities of carburetted hydrogen. The analyses refer to I, from a spring about three miles above the church, and II, from a spring at the ferry landing directly opposite the church. The specimens examined were collected in August 1853.

	Trudel's spring I	Ferry spring II
Chloride sodium	17·2671	11·5094
" potassium	·2409	undet
" calcium	·6038	·2264
" magnesium	2·0523	·8942
Bromide magnesia	·0587	·0273
Iodide "	·0133	·0183
Carbonate lime	0120	·0180
" magnesia	·7506	·4464
" iron	traces	traces
Alumina	undet	undet
Silica	undet	undet
In 1,000 parts of water	20·9987	13·1400

St. Hyacinthe, St. Hyacinthe Co.—A mineral water, which is now finding a ready sale throughout the province of Quebec, is obtained at St. Hyacinthe and sold under the name of "Philudor." No data are available beyond the following analysis made by Prof. C. P. Choquette, of St. Hyacinthe College:

Chloride sodium	3·6923	Carbonate manganese	·0114
" potassium	·1230	Sulphur	·0009
" magnesium	·0415	Alumina	·0041
" lithium	·0074	Silica	·0246
Sulphate calcium	·0319	Titanic acid	traces
" barium	·0032	Free carbonic acid	·0461
" strontium	·0024	Carbonic acid (forming bicarbonates)	·0983
Carbonate sodium	·0422		
" magnesium	·0648		
" iron	·0371		
Residue at 180° C in 1,000 parts of water			4·4423

St. Lèon, Maskinongè Co.—The best known and most widely used medicinal water found in Canada is undoubtedly that obtained at St. Leon Springs. Large quantities of this water are annually sold in all the important cities and towns of the Dominion and considerable quantities are of course used in the baths etc, at the sanitarium erected

near the spring. The water is strongly saline and slightly chalybeate and at the spring evolves considerable quantities of carburetted hydrogen. The following analysis was made by Dr. T Sterry Hunt and was confirmed by Prof. O. F. Chandler of Columbia College, New York, and Jno. Baker Edwards Ph.D. etc.

Chloride sodium	677.4782	Phosphate soda	·1690
" potassium	13·6170	Bi-carbonate lime	29·4405
" barium	·6099	" magnesia	82·1280
" strontium	·5070	" iron	·6856
" calcium	3·3338	Alumina	·5830
" magnesium	59·0039	Silica	1·3694
" lithium	1·6147		
Bromide sodium	·8108	Grains in imp. gallon	871·6681
Iodide "	·2479	Specific gravity	1011·8
Sulphate lime	·0694		

Another spring (*a*) in this neighborhood occurring about a mile from the church at St. Leon and in the valley of the Rivière à la Glais, affords a very similar water to the foregoing. The water is saline, has a marked chalybeate taste and contains traces of baryta and lithia, and is accompanied by large quantities of carburetted hydrogen. The analysis of a specimen collected in October 1848 gave the following result:

Chloride sodium	11·4968	Carbonate lime	·3493
" potassium	·1832	" magnesia	·9388
" barium	·0019	" iron	·0145
" strontium	·0019	Alumina	·0865
" calcium	·0718	Silica	·0145
" magnesium	·6636		
Bromide magnesium	·0091	In 1,000 parts of water	13·8365
Iodide "	·0046	Specific gravity	1011·23

Ste. Martine, Beauharnois Co. (*a*)—"A feebly saline water from the parish of Ste. Martine, in Beauharnois, * * * probably rises from the Calciferous formation. It gives 1·98 parts of solid matter to 1,000 and contains a small portion of sulphates. The spring is said to be sulphurous"—vide Geology of Canada, 1863.

St. Ours, Richelieu Co. (*a*)—Some years prior to 1852, in which year the specimen affording the following analysis was collected, a spring was tapped while constructing a lock on the Richelieu River at St. Ours. As the water could only be obtained by means of a pump it was difficult to state positively as to the purity of the specimen obtained The analysis illustrates the character of the water afforded:

Chloride sodium	·0207	Carbonate iron	traces
" potassium	·0496	Alumina	undet
Sulphate potash	·0081	Silica	·0160
Carbonate soda	·1340		
" lime	·1740	In 1,000 parts of water	·5311
" magnesia	·1287		

St. Sèvère, St. Maurice Co.—The water of a spring occurring in this parish has lately been put upon the market under the name of "Mineral water Divina" though with what success, and under what conditions the water occurs, are not known to the writer. The only available analysis is that by Profs. Favard and Pfister of Montreal:

Chloride sodium	551·68	Phosphate soda	·96
" potassium	38·59	Bi-carbonate lime	8·61
" lithium	7·29	" magnesium	119·72
" barium	trace	" iron	18·01
" calcium	1·49	" manganese	·28
" magnesia	58·18	Alumina	37·85
Bromide sodium	398·87	Silica	5·46
Iodide "	6·42		
Sulphate lime	trace	Grains in imp. gallon	1255·25

Varennes, Vercheres Co. (*a*)—Two springs known locally as the "Saline" and "Gas" springs occur at this place, the waters rising through the clay from rocks near the summit of the Utica or base of the Hudson River formation. In both instances carburetted hydrogen is given off, in the case of the saline spring in but small quantities at infrequent intervals, while from the gas spring sufficient was evolved at one time to warrant its collection and utilization in the lighting of the house that had been erected over it. In November 1847 the temperature of the Saline spring was 47° F. and that of the Gas spring 40° F., the air being 19° F. Again on the 18th of October in the following year the temperature was taken and found to be 47·5° F. in the Saline spring, while the Gas spring was 45·5° F. the atmosphere being 44° F. The following analyses are available:

	Saline Spring	Gas Spring
Chloride sodium	9·4231	8·4286
" potassium	·1234	·0382
Bromide sodium	0126	·0046
Iodide "	·0054	·0085
Carbonate soda	·1705	·3260
" baryta	·0226	·0123
" strontia	·0140	·0096
" lime	·3540	·3490
" magnesia	·5433	·3559
" iron	·c048	traces
Alumina	traces	"
Silica	·0465	·0540
In 1,000 parts of water	10·7202	9·5867
Specific gravity	1008·15	1007·7

MINERAL WATERS IN NEW BRUNSWICK.

Apotaqui, Kings Co.—A mineral water known as "Apotaqui Mineral Water" is obtained from a spring about one mile east of the village of Apotaqui, and has lately been put upon the market with marked success, being used, both medicinally and in the pure state as an emulsifier of the fatty oils for which purpose it is eminently satisfactory, making, especially with cod-liver oil, a perfect and thorough emulsion. It has also been used with beneficial effect in the cure of diabetes and gravel and other bladder affections, as well as derangements of the digestive organs.

An analysis made in 1886, by Mr. W. F. Best of St. John resulted as follows :—

Chloride sodium	·7600	Iron	traces
" potassium	·0108	Silica	·0090
Sulphate "	·0050	Organic matter	traces
Carbonate calcium	·0125		
Bi-carbonate sodium	2·0160	In 1,000 parts of water	2·8183
Magnesium	traces		

Bennet's Brook, Kings Co.—Near the head waters of Bennet's Brook are several springs, the waters of which might possibly be more correctly classed under the head of brines, though they have acquired a local celebrity on account of their supposed medicinal properties. No examination has been made as to their contents.

Havelock, Kings Co.—The spring known as the "Havelock Mineral Spring" is situated in the village of that name and has a daily flow of about 700 barrels. This water is shipped throughout the lower provinces and it is claimed has a highly curative effect upon skin diseases and affections of the digestive organs.

An analysis made in 1889, by Mr. W. F. Best, of St. John gave the following result :—

Chloride sodium	35·13	Bi-carbonate magnesium	84·55
Sulphate potassium	8·27	Iron	trace
" calcium	1·46	Iodine	"
Sulphur	·09	Silica	"
Bi-Carbonate sodium	12·44		
" calcium	19·80	Grains in imp. gallon	161·76

Norton Dale, York Co.—In the vicinity of Norton Dale, a settlement on the Nacawicac River, is a spring affording a water which

evolves a sufficient quantity of sulphuretted hydrogen, to give the water a strong sulphurous taste and odour. No examination of the water has been made, though it is said to be used to a considerable extent locally. Many similar springs are known to occur in the vicinity, of none of which, however, is anything definite known.

MINERAL WATERS IN NOVA SCOTIA.

Bras D'Or Lake, Victoria Co.—On the north shore of the Little Narrows, Bras D'Or Lake, and about twelve miles south-west of Baddeck are several brine springs, a specimen of the water of which was examined by Mr. G. C. Hoffmann (report Geol. Surv. 1873-4, p. 181). Although more correctly a brine, it has been thought advisable to note its occurrence here, the following analysis is by Mr. Hoffmann:

Chloride sodium	50·6881	Alumina	traces
" potassium	·1942	Silica	"
" magnesium	·1593		
Sulphate calcium	5·6810	In 1,000 parts of water	56·7226

Unsuccessful efforts were made to utilize this brine in the manufacture of salt; works etc. having been erected and abandoned many years prior to 1873. Mr. Chas. Robb, who collected the specimen examined, states that in the neighborhood of the springs, of which there are several, there is a noticeable odour of sulphuretted hydrogen.

East Bay, Cape Breton Co.—At the junction of the Ben Eoin and Gaspereaux River roads, and about four miles from the shores of East Bay, is a spring which at one time had a comparatively wide reputation and was resorted to by many in search of relief from rheumatic troubles. The spring rises from syenitic rocks and the water has an unpleasant brackish and astringent taste. An analysis afforded Prof. Hy. How, Kings College, Windsor, the following result:

Chloride sodium	343·11	Phosphoric acid	traces
" potassium	4·55	Carbonate lime	·60
" calcium	308·90	" magnesia	
" magnesium	4·47		
Sulphate lime	·94	Grains in imp. gallon	662·57
Iron	traces	Specific gravity at 54° F	1007·397

Grande Anse, Richmond Co.—In the "Mineralogy of Nova Scotia 1868," page 194, Prof. Henry How, writes thus of a water found at this place:—"At Grande Anse, at the mouth of the McKenzie River, two springs issue from the metamorphic Lower Carboniferous rocks

resting on the flanks of a mountain of granite and syenite. The first is highly sulphurous and contains sulphate of magnesia, and the water has very decided aperient qualities. The little pool in which it rises is coated with a white earthy deposit; gas is evolved, particularly when the neighboring ground is trodden on. The second water is mentioned as having a strong taste of magnesia, not having any sulphurous odour, and as being much used as a gentle laxative."

Halowell Grant, Antigonish Co.—About eight or nine miles north of Antigonish and on the Halowell Grant is a spring, the water of which was analysed by Mr. G. C. Hoffmann (report Geol. Surv. Vol I. 1887, p. 15 M.) and gave the following result:—

Chloride sodium	·0793	Carbonic acid half. combined	·0457
" potassium	·0137	" free	·0075
Sulphate lime	·3388		·5922
Carbonate lime	·0666		
" magnesia	·0296	Chlorine, in excess of that required	
" iron	·0024	by the potassium and sodium	·0001
Alumina	·0005		
Silica	·0081	In 1,000 parts of water	·5923
Phosphoric acid	traces	Specific gravity at 15·5° C	1000·53
Organic matter	traces		
	·5390		

The water was inodorous and devoid of any special taste and had a faint brownish tinge.

Queensville, Inverness Co.—The water of a spring at McMaster's Mill, Queensville, was examined, (report Geol. Surv. 1879-80, page 7 H) a qualitative analysis showing it to contain the following to the extent of 5·859 parts of dissolved solid matter in 1,000 parts of water.

Potassa	a trace	Sulphuric acid	a small quantity
Soda	a very large quantity	Phosphoric acid	a " "
Lime	a small "	Carbonate acid	a " "
Magnesia	a small quantity	Chlorine	a " "
Ferrous oxide	a " "		

Neither bromine nor iodine were detected.

Wilmot, Annapolis Co.—A curative water now attracting considerable attention is obtained near the town of Middleton at what are known as the Wilmot Spa Springs. These springs have been utilized since 1830, though the highly curative power of the water was known prior to that. Besides the quantity annually used at the sanitarium erected at the springs, large quantities are now used in the preparation

of aerated table waters and ginger ale. Several analyses are available, all of which have been made by Prof. Hy. How of Windsor. Of these the following is typical and is thought sufficient:

Chloride potassium	1·60	Carbonate iron	·14
Sulphate soda	8·35	Phosphoric acid	traces
" lime	121·98	Silica	·55
" magnesia	5·35	Organic matter	traces
Carbonate lime	2·70		
" magnesia	·37	Grains in imp. gallons	141·04

Windsor, Hants Co.—The following analysis was made by Prof. Hy. How, (Mineralogy of Nova Scotia, 1868, page 195) of a water from a spring which rises from Lower Carboniferous rocks near Windsor. The water was collected in 1858 and was found to be perfectly colorless and to have but little taste; its temperature was 49° F, that of the air being 31° F, and the specific gravity at 49° F, 1001·858.

Chloride sodium	0·90	Silica	0·60
Sulphate soda	0·68	Phosphoric acid and organic	
" potassa	0·38	matter	trace
" lime	106·21		
" magnesia	11·02	Grains in imp. gall	138·00
Carbonate lime	17·50	Free carbonic acid (1.35 cubic	
" magnesia	0·31	ft. at 33° F.)	0·64
" iron	0·40		

Miscellaneous localities—Throughout the reports of the Geological Survey, in How's Mineralogy of Nova Scotia 1868, and many other publications, may be found mention of many springs, specific information regarding which is not given. Among these may be mentioned the so-called Thermal Spring of Chester, Lunenburg Co., which is said to afford a slightly better water, probably alkaline in character. At Cheticamp, Inverness Co., a water is found which is said to have medicinal properties as is also the case at Gairloch, Pictou Co., and Earltown, Hants Co. Another spring, mentioned by Mr. Hugh Fletcher, (report Geol. Survey. 1876-78, page 456) as occuring near Deadman's Point, Washaback, Pictou Co., affords a brine smelling strongly of sulphuretted hydrogen. In Pictou Co., near the mouth of Sutherland's River, a brine used locally for medicinal purposes issues into the bed of the river, and at St. Andrews in the same county is located the so-called "Rotten Spring," the waters of which have acquired a local reputation as a cure for rheumatic and other diseases. Other localities mentioned by Mr. Fletcher (report Geol. Surv. 1879-80, page 133 F)

are: Rabbit Isd, Landrie Lake and River Tillard, the water from the two latter places being chalybeate in character, while that from Rabbit Island is highly charged with sulphur, which is deposited in the pond into which it flows.

MINERAL WATERS IN MANITOBA AND THE NORTH WEST TERRITORIES.

Banff, Alberta.—The waters of the Thermal springs at this place have of late years commanded considerable attention, though more particularly since the inaugaration of the Banff National Park and the erection by the Canadian Pacific Ry., of their large sanitarium. The curative properties of the waters are too well known to require further mention here.

In the Geol. Surv. Rep. III, part II, 1887-88, p. 21 T, is an analysis of a specimen collected by Mr. R. G. McConnell:

Chloride sodium	·0110	Silica	·0398
Sulphate soda	·0089	Organic matter	trace
" potassa	·0096		
" magnesia	·2070		·9551
" lime	·5627	Carbonic acid, half combined	·0510
Carbonate lime	·1148	" free	·0434
" iron	·0013		
Alumina	undet	In 1,000 parts of water	1·0495

"The water was examined for lithia, iodine, and bromine, but no other constituents. Distinct evidence was obtained of the presence of lithia; iodine and bromine were not detected; this does not necessarily imply that they were not present in the water, in as much as the amount of water operated on was far less than would be required for the detection of traces, or even very small quantities of these substances. Geol. Surv. Rep. Vol III., 1887-88, part II, p. 22 T.

The physical features most apparent were: colourless; devoid of any marked taste; odourless; reaction faintly alkaline; specific gravity of filtered water, at 15.5° C. = 1000·99. Mr. McConnell in referring to this spring says:—"The water has a temperature of 111° F. in summer, but it is said to rise to 119° F. in winter. The lower temperature in summer may be caused by the water being affected to some extent by the surface drainage, which is more active at that season. It has a large flow, and is forced up in large quantities through an aperature several inches in diameter" * * Ibid, page 21 T.

Brandon, Manitoba.—A partial analysis was made in the laboratory of the Survey—Geol. Surv. Rep. 1882-84, p. 18 MM.—of a water from a shallow well north of Brandon :

Potassa and soda	a large quantity ; soda predominating
Lime	a "
Magnesia	a "
Sulphuric acid	a very large quantity
Carbonic acid	a rather large quantity
Chlorine	a " small "
Sulphuretted hydrogen	

After being filtered it was found to have a content of solids—dried at 100° C = equivalent to 268·9 grains to the imp. gall. The water at the time of the examination smelt strongly of sulphuretted hydrogen and had a most offensive odour.

Clearwater River, N. W. T.—In the same volume an analysis is given of a specimen collected by Dr. Robert Bell and labelled as follows :—" Salt resulting from the evaporation of about five and a half quarts of water of a spring situated on the north bank of the Clearwater River, about four miles below the Cascade Rapid, N. W. T. From $\frac{1}{3}$ to $\frac{1}{4}$ more adhered to the kettle and was lost." The residue handed in for examination weighed 595 grains.

Potassa	very small quantity	Ferric oxide	very small quantity
Soda	" large "	Sulphuric acid	" large "
Lime	" " "	Chlorine	" " "
Magnesia	" "	Carbonic acid	" " "
Alumina	" small "	Insoluble residue	" " "

Rosenfeld Station, Manitoba.—The water was obtained from an artesian boring made at Rosenfeld Station, C. P. R., at a depth of 235 feet, from which depth and lower points the water rises and flows in considerable quantities, Mr. G. C. Hoffmann, Geol. Surv. Rep. I, 1885. p. 13M—says :—The filtered water was perfectly colorless ; taste, strongly saline with a very slight bitter after taste ; it did not affect the color of turmeric paper, but exhibited a slightly alkaline reaction with reddened litmus paper. The reaction for boric acid, although faint, was quite distinct. Bromine and iodine are both present—the amount of the former exceeding, apparently, that of the latter,—but owing to a total insufficiency of material, the determination of the respective amounts of these constituents, could not be carried out. The specific gravity of the water, at 15·5° C., was found to be 1032·86."

The analysis gave the following result:—

Chloride sodium	36·4971	Sulphate lime	4·1511
" potassium	·4179	Carbonate lime	·0777
" calcium	·3982	" iron	traces
" magnesium	1·7225	Silica	·0126
Bromide magnesium	undet		
Iodide magnesium	undet	Total dissolved solid matter by	
Borate soda	undet	direct experiment dried at 180° C	43·4280

"The proportion of magnesium assumed to be present as bromide and iodide, amounts to 0·0596"

Sulphur Coulée, Manitoba.—Water which rises from Cretacean shales, was obtained by Dr. G. M. Dawson from the so-called Sulphur Spring, in Sulphur Coulée, near its junction with the Pembina River, and submitted for examination to Mr. G. C. Hoffmann, who reports as follows:—Geol. Surv. Rep. II, 1886. p. 13 I:—The filtered water had a specific gravity at 15·5° C., of 1000·42 and contained 0·862 parts dissolved saline matter, dried at 180° C., in 1000 parts, by weight, of the water." A qualitative analysis gave the following result:—

Potassa	small quantity	Sulphuric acid	large quantities
Soda	rather large quantity	Carbonic acid	" "
Lithia	very small quantity	Chlorine	" "
Lime	large quantity	Organic matter	small "
Magnesia	" "		

Western Butte, Sweet Grass Hills, Alberta.—In the same volume Mr. Hoffmann gives the following result of the examination of a specimen collected by Dr. G. M. Dawson from a spring at foot hills of Western Butte, Sweet Grass Hills, where the water rises from dark Cretaceous shales. "The water, which as it issues from the spring, is charged with sulphuretted hydrogen, still contained a large quantity of that gas. It contained some suspended and sedimentary matter, consisting of carbonate of lime, a little iron, and separated sulphur, together with argillaceous and organic matter, and some sand. The filtered water had a specific gravity, at 15·5° C., of 1001·36. Total dissolved saline matter, dried at 180° C., equalled 0·857 parts in 1000"

A qualitative analysis gave the following result:—

Potassa	trace	Ferrous oxide	trace
Soda	small quantity	Sulphuric acid	small quantity
Lithia	very distinct quantity	Carbonic acid	very large quantity
Lime	fairly large quantity	Chlorine	small quantity
Magnesia	very " "	Hydrosulphuric acid	large "
Alumina	" small "	Organic matter	small "

MINERAL WATERS IN BRITISH COLUMBIA.

Dougherty's Spring, Maiden Creek.—This spring known also as the "Carbonic Acid Spring" on account of the great quantities of that gas evolved, is on Maiden Creek, south of Clinton, and between that place and Cargeriles.

Water, collected by Mr. A. Bowman, was examined by Mr. G. C. Hoffmann, (Geol. Surv. Rep. II, 1886, p. 13 T:)—

Potassa	trace	Sulphuric acid	fairly large quantity
Soda	small quantity	Carbonic acid	large quantity
Lime	large "	Silica	small "
Strontia	trace	Chlorine	" "
Magnesia	large quntity	Organic matter	" "
Alumina	very small quantity		

The water when filtered was found to have a specific gravity, at 15·5° C., of 1000·90 and contained in 1000 parts of water 1·442 parts of dissolved solid matter, dried at 180° C.

Harrison Hot Springs.—At the southern end of Harrison Lake two springs have been noted viz:—The Potash Spring and The Sulphur Spring, both of which are thermal. Samples of the water were examined. (Geol. Surv. Rep. IV, 1888-89, part R.)

Potash Spring.—Temperature of water at spring 120° F. The filtered water was perfectly colourless, inodorous and had a slightly saline taste; it showed alkaline reaction with reddened litmus paper but did not affect turmeric paper

Chloride sodium	·4059	Carbonate iron, very small amount	undet
" potassium	·0202	Alumina	undet
" lithium	undet	Silica	·0586
Sulphate soda	·4107	Organic matter	trace
" lime	·2256		
" megnesia	·0024	In 1,000 parts of water	1·1600
" strontia	undet	Specific gravity at 15·5° C.	1001·00
Carbonate lime	·0366		

Sulphur Spring—Temperature of water at spring, 150° F. Physical features similar to last with the exception of the specific gravity, which was at 15·5° Co., 1001·13.

Chloride sodium	·4471	Sulphate strontia	undet
" potassium	·0246	Bi-carbonate lime	·0621
" lithium	undet	Alumina	trace
Sulphate soda	·4723	Silica	·0662
" lime	·2120		
" magnesia	·0021	In 1000 parts of water	1·2864

Hot Spring Island, Queen Charlotte Islands.—No analysis of the thermal waters from the spring on this island is available, the only information at hand is that found in the report on the Queen Charlotte Islands, by Dr. G. M. Dawson, (Geol. Survey Rep., 1878-9, p. 22 B). "On the south side of Hot Spring Island is the spring from which it has been so named. Its situation is easily recognized by a patch of green, mossy sward, which can be seen from a considerable distance. Steam also generally hovers over it. The actual source of the water is not seen, but is probably not far from the inner edge of the mossy patch. * * I had no thermometer reading sufficiently high to take the temperature of the warmest streams, in which the hand could scarcely be held with comfort. * * The water has a slight smell of sulphuretted hydrogen, and a barely perceptible saline taste. The stones over which it flows, in some places show traces of a whitish deposit, and the streams and pools are choked with a slimy confervoid growth."

Nanaimo, Vancouver Island.—In Geol. Surv. Rep., 1872-73, p. 82, is an analysis of a saline water, from the so-called "Salt Spring at Nanaimo." The water, according to Mr. Jas. Richardson, who collected the specimen, issues from the coal-bearing strata near the Douglas seam, and had, in 1872, an estimated flow of about 3,500 gallons per diem. The Hudson Bay Co., prior to that date, had erected a building near the spring with the intention of manufacturing salt from the water, but the enterprise was abandoned, probably on account of the impurities the product would contain.

Chloride sodium	39·117	Carbonate iron	traces
" potassium	·627	Alumina	·038
" calcium	10·049	Silica	·038
" magnesium	·135		
Sulphate lime	1·803	In 1000 parts of water	52·154
Carbonate lime	·347	Specific gravity	1;039·00

Shuswap Lake.—In Geol. Surv. Rep., 1877-78, p. 25 B, Dr. G. M. Dawson describes a spring on the Spallumsheen Arm, Shuswap Lake. The spring is known to the Indians as "Pil-pil-poopil," and flows into a shallow bay. No data regarding the character of the water are available, beyond the fact that it has a faint, ferruginous taste, and traces of sulphuretted hydrogen. The temperature of the water as it comes to the surface of tbe bay was, in August, 1877, 70° F.

Upper Columbia Lake, North End.—About seven and a half miles north of the north end of Upper Columbia Lake is located a thermal spring, the water of which afforded (Geol. Surv. Rep. II, 1886, p. 15 T) the following result :

Potassium.....trace	Sulphuric Acid ....very large quantity
Soda.....rather small quantity	Carbonic acid..... " " "
Lithia.....trace	Silica .....trace
Baryta ..... "	Chlorine.....fairly large quantity
Strontia .....very small quantiy	Organic matter....small quantity
Lime ..... " large "	In 1000 parts of water, dried
Magnesium .....large quantity	at 180 °C..... 2·177
Ferrous oxide .....trace	Specific gravity at 15·5° C ..... 1001·48

Dr. G. M. Dawson, who collected the specimen, states that the discharge is not less than 20 gallons per minute, and that the temperature at the hottest point was 112°F.

Vermillion Pass.—Dr. G. M. Dawson reports several chalybeate springs which flow out through the gravel on the river flats about 6 miles west of the summit and near the place alluded to in his report as "the bend." He states that the springs are copious and of such a character as to suggest their use medicinally.—*Vide* Geol. Surv. Rep. I, 1885, p. 120 B.

Many thermal and other springs are, of course, known locally in British Columbia, but no data are available. Of some, however, although no analyses are at hand, the following notes by Dr. G. M. Dawson in his "Report on the Mineral Wealth of British Columbia Geol. Surv. Rep. III, 1887-88, 162 R. may not prove uninteresting.

"*Admiralty Island.*—Salt spring. According to analysis quoted by Pemberton in the place above cited (Nanaimo). The spring contains 65 parts of saline matter to 1,000, but with more impurities than the last (Nanaimo)."

"*Near Lilooet River.*—about five miles from head of Harrison Lake. Hot springs known as St. Agnes's Well; no particulars."

"*Sinclair Pass*—Rocky Mountains, Hot Springs, on south side of Berland's Brook, near the point at which it issues from the mountains into the Upper Columbia valley. Three springs reported, and said to be copious. Mr. John McKay, who discovered these springs, states the temperature of one as 118° F."

"*Elk River Valley.*—Rocky Mountains, about lat. 50°7 ; warm sulphur spring reported on east side of river, by Mr. H. M. Hatfield."

"*Kootanie Lake.*—Hot springs, giving its name to the "Hot Springs Mining Camp." Situated on west side of lake, directly opposite the "Blue Bell Claim." Several springs occur near the edge of the lake and some below the water level, temperature estimated at about 100° F."

"*Upper Arrow Lake.*—Hot springs. On the east side of the lake, twelve miles from its head, and one hundred and fifty yards from the lake. Said to be about as hot as can comfortably be borne in bathing."

"*Albert Canyon Station. C. P. Ry.*—Hot spring. About a mile to the north of the station. Temperature about the same as the last.

"*Near Upper Arrow Lake.*—Hot spring reported by Indians at some distance back from the lake, 3 or 4 miles from its southern end."

"*Near Albert Canyon Station.*—"Soda spring." One mile and a half west of the station on south side of the track. This and the following springs are known as "soda springs" in consequence of the presence of large quantities of carbonic acid gas."

"*Near Carne's Creek.*—On west side of Columbia River and opposite the mouth of Carne's Creek. Groups of springs with copious escape of carbonic acid gas."

"*Near Downie Creek.*—"Soda spring." Is situated about three fourths of a mile north-west of the trail from Downie to Gold creek and about four miles from the latter."

"*Four miles above Smith's Creek.*—West side of Columbia River. Springs with considerable escape of carbonic acid gas, and deposition of iron-oxide, reported."

"*Skeena River.*—Left bank about fourteen miles above "Inverness Cannery." Hot spring, no particulars."

"*Stikine River.*—Hot spring. Situated a short distance above Buck's Bar and directly opposite the Great Glacier. No particulars."

"*Kennicot Lake.*—At head of south branch of Taku River. Hot spring. Said to feed the lake. (Alaska and its Resources. Dall, p. 628)"

"*McDonald's Oil Spring.*—Head waters of Omineca River, lat. 56° This spring is marked as above on Trutch's map of British Columbia. It is not, however, an oil spring, but is described as a smalll mound in the centre of which a hollow exists charged with carbonic acid to such an extent as to prove fatal to birds and small animals."

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